

# REPORT DOCUMENTATION PAGE

AFRL-SR-AR-TR-02-

Public reporting burden for this collection of information is estimated to average 1 hour per response, including gathering and maintaining the data needed, and completing and reviewing the collection of information. Send all collection of information, including suggestions for reducing this burden, to Washington Headquarters Service, Paperwork Project, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Project, Suite 1204, Arlington, VA 22202-4302.

Number of copies of this report

0340

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 29 Nov 01	3. REP FINAL REPORT 30 Sep 94 TO 29 Jun 01		
4. TITLE AND SUBTITLE ASTRONOMY ORIENTED SCIENCE CENTER			5. FUNDING NUMBERS F49620-94-1-0425		
6. AUTHOR(S) JOHN T. MCGRAW			4284/AS 61102F		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The New Mexico Astronomy Science Center Consortium Institute for Astrophysics Albuquerque, NM 87131-6003			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NL 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977			10. SPONSORING/MONITORING AGENCY REPORT NUMBER		
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION AVAILABILITY STATEMENT  Approve for Public Release; Distribution Unlimited			12b. DISTRIBUTION CODE		
13. ABSTRACT (Maximum 200 words) Substantial progress was made on returning CTI to a fully operational state. CTI will be a scientifically useful research telescope, capable of addressing a broad spectrum of Galactic and extragalactic projects as soon as these tasks are completed. CTI data will support multiple thesis programs and will be pedagogically useful for elementary and secondary educational programs.					
14. SUBJECT TERMS			15. NUMBER OF PAGES		
			16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT		18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	

20021031 001

**University of New Mexico  
Final Technical Report  
AFOSR Grant # F49620-94-1-0425  
November 27, 2001**

**TABLE OF CONTENTS**

1. Introduction	Pages 1-2
2. Technical Aspects of the Project	Pages 3-12
▪ NM Tech Collaboration	
▪ Capilla Peak	
▪ Interferometry at Enchanted Skies Park	
▪ CTI Remote Telescope Development	
3. Educational Outreach	Pages 13-15
4. LodeStar Astronomy Center	Pages 16-24
5. Description of Exhibits at the LodeStar Astronomy Center	Pages 25-31
6. Enchanted Skies Park	Page 32
7. Chronology of the LodeStar Project	Pages 33-36

## INTRODUCTION

In 1993, Congress authorized a grant "for an astronomy-oriented science center/observatory to be located in a large urban school district with a joint power agreement by a city, regional park district, school district, and an astronomical association."

The Air Force Office of Scientific Research ("AFOSR") issued BAA 93-94 soliciting proposals for the astronomy-oriented science center that had been specified in the congressional appropriation language.

On behalf of the University of New Mexico, John McGraw submitted a proposal to the AFOSR in 1993 for Cosmic ¡Explora!, which later was renamed LodeStar. The proposal was submitted on behalf of the other members of the New Mexico Astronomy Science Center Consortium, who were signatories to the proposal and had joined together to develop and construct an astronomy-oriented science center. The other members of the consortium included the State of New Mexico, the Pueblo of Acoma, Albuquerque Public schools, the Air Force's Phillips Laboratory, New Mexico Tech, the City of Albuquerque, Sandia National Laboratory, and Los Alamos National Laboratory.

link

In the proposal, the University of New Mexico said that it intended to:

1. Develop an astronomy center in Socorro, New Mexico with a remotely controlled 30-inch telescope and control room capable of receiving data from remote sites, which was to be located at New Mexico Tech.

Due to problems with NM Tech's compliance with the terms of its subcontract for this aspect of the project, a substitution was made with the Capilla Peak observatory and a control room at the LodeStar Astronomy Center (LAC). ← *unaccept.*

2. Develop a public access observatory site incorporating both state-of-the-art research telescopes and remotely controllable smaller telescopes for use by students.

This aspect of the project, which became known as Enchanted Skies Park ("ESP"), was proposed for Acoma Pueblo initially, but the site was changed later to Horace Mesa in Grants. The LodeStar project was terminated prior to the completion of ESP.

3. Develop a hands-on astronomy center in Albuquerque.

*enchanted  
skies*  
This has been accomplished by the development and operation of the LodeStar Astronomy Center.

4. Provide educational outreach to students in grades K-12, to teachers, and the public.

This has been accomplished through LodeStar's successful public outreach program.

5. Provide distance learning opportunities for New Mexico's schoolchildren through a remotely accessed telescope.

This has been partially satisfied, though the link between UNM's Capilla Peak observatory and the LodeStar Astronomy Center needs to be completed. *> ask*

6. Provide teacher training and educational materials for the study of science.

This has been satisfied through LodeStar's educational outreach program and through LodeStar's collaboration with NM Tech.

7. Provide cross-cultural educational programs.

This has been satisfied, to some extent, through LodeStar's educational outreach program. The uncompleted Enchanted Skies Park was to provide additional opportunities for such programs.

## **TECHNICAL ASPECTS OF THE LODESTAR PROJECT**

### **I. New Mexico Tech Collaboration**

#### **Introduction and Timeline**

New Mexico Tech began participating in LodeStar (or, as it was then called, ; Cosmic Explora!) in the summer of 1993. Its initial contribution was to help with the proposal. Work on the funded proposal began in late 1994. With the expiration of the contract between LodeStar and Tech, work stopped at the end of September 1999.

#### **Accomplishments**

##### **Environmental Compliance and Tech's Role in the Initial Release of Funds**

For practical purposes the first accomplishment was to meet with representatives of the Air Force to discuss Tech's Environmental Assessment and to request a Categorical Exclusion because all work was to be done within existing buildings. On November 9, 1994, Major Norb Diaz, JAG Officer, AFOSR, Ms. Julie Cantrell, Air Force Office for Environmental Excellence, Mr. William Dick, Air Force Office for Environmental Excellence, Dr. John McGraw, and Ms. Sharon Janecka came to the Tech campus. They met with Prof. Westpfahl, Prof. William Winn, the Director of Langmuir Laboratory, Mr. Harvey Wilds, Tech's Director of Finance, and President Lopez. They discussed the request for a categorical exclusion and the possibility of separating Tech's role in LodeStar from the roles of the other institutions so that Tech's funds might be released, allowing work to start. Tech agreed to take the lead in site testing so that the selection of a site for Enchanted Skies Park could start in a timely manner. After suitable discussions and gathering of data the paperwork for the CATEX was completed in March of 1995. Funds were released shortly afterwards and the site testing effort began.

#### **Site Testing**

From April 1995 to March 1996, Tech participated in astronomical site testing in Cibola County to identify a site for Enchanted Skies Park. Tech faculty and graduate and undergraduate students helped in the design of the instruments, erection of the test towers at four sites, gathering and reduction of the data, and writing of the site-testing report.

#### **Informal Education and Public Programming**

NM Tech's informal education has been centered at the Etscorn Campus Observatory (described separately below, under Facilities), which was upgraded and operated with LodeStar funds. Annual visitorship has increased each year and is now over 2000. There have been hundreds of public star parties over the course of the LodeStar project, most

were put on by the Tech Astronomy Club. The highpoint of the year is the Enchanted Skies Star Party, which has occurred each year in October.

### Undergraduate Education

The Etscorn Campus Observatory (described below, under Facilities) has been used for Tech's undergraduate Laboratories, Physics 327 and 328, each year from 1995 to 1999. The LodeStar computers and CCD cameras have been used by the class Image Processing, Physics 362. This class has been offered five times, every spring semester from 1995 to 1999. Three groups of Electrical Engineering Senior Design students, totaling 10 individuals, have used LodeStar funds for their capstone senior design projects.

Prof. David Westpfahl attended the International Conference on Undergraduate Physics Education at the University of Maryland in July of 1996 using LodeStar funds. Discussions of the material presented at the conference have contributed to a lively review of introductory physics at Tech.

### Graduate Education and Teacher Training

Teacher training was conducted through Tech's Master of Science Teaching (MST) program. Originally, NM Tech planned to offer only one course, Astronomy for Teachers, as part of LodeStar teacher training. During the initial offering, in the summer of 1995, Tech found that most teachers in the program did not have enough training in computers to use them to observe remotely. Remote use of telescopes by teachers and their students is one of the cornerstones of LodeStar. This lack of training prompted Tech to start an additional course, Computers and the Internet, which was first offered in the summer of 1997. By request of the teachers in the program they also offered Teaching Advanced-Placement Physics. In 1997, Tech established a relationship with Albuquerque Academy and began to offer MST classes at their campus in Albuquerque.

Classes have been offered throughout the 1995 to 1999 period, some under LodeStar sponsorship and some under Tech sponsorship. Astronomy for Teachers was offered at Tech in the summers of 1995, 1996, and 1998, and at Albuquerque Academy in the fall of 1999. Enrollments were 7, 12, 19, and 14, respectively.

Computers and the Internet was offered at Tech in the summers of 1997, 1998, and 1999 and at Albuquerque Academy in the fall of 1998. Enrollments were 12, 18, 14, and 10, respectively.

Teaching Advanced-Placement Physics was offered at Albuquerque Academy in the spring of 1997. Enrollment was 3.

Tech's graduate classes benefited from the use of LodeStar computers and from the upgrades to the Etscorn Campus Observatory (see below). Physics 565, Astronomical Techniques, was offered in the fall of 1995, 1997, and 1999. The students in these

classes performed several of the upgrades, including installation of the new automated mount and testing of the CCD camera. Physics 566, Advanced Radio Astronomy, was offered in the spring of 1994, 1996, and 1998. These classes made extensive use of the LodeStar computers. Physics 571, Modern Optics, made extensive use of the LodeStar computer and CCD camera in the optics lab.

Several graduate students used LodeStar facilities in their thesis work, some received LodeStar financial support. The beneficiaries are listed below.

#### Graduate Students Supported

Master of Science - Thomas Tongue, Margaret Graham, Jordan Alexander, Bruce Nemitz, Denis Oesch, Howard Beckley, Katrina Koski

Master of Science Teaching - Bruce Smith, Barry Winters, Cindy Schenke, Martha Dyer, Hank Starr, Apurna Joshi, Paula Rogan, Phyllis Kempter, Rich Salaz

Doctor of Philosophy - Alison Peck, Paul Arendt

#### Faculty Involvement and Minority Faculty Development

The Tech faculty involved in LodeStar have been David Westpfahl, Daniel Klinglesmith, and Leonard Truesdell. In addition, LodeStar funds were used in part to support Paul Coleman in a two-year visiting position. Paul is one of the few native Hawaiians with a Ph.D. in Astrophysics. During his time at Tech he made an unofficial specialty of advising Native American students. Through his efforts several Native Americans studied introductory physics and participated in other activities of the Physics Department.

#### Relationships with the National Labs

Throughout the LodeStar project Tech has maintained vigorous and collegial relationships with groups at the Air Force Research Laboratory (formerly Phillips Laboratory) and Los Alamos National Laboratory, two institutions whose directors signed the original LodeStar proposal. These relationships have resulted in several educational opportunities for Tech students.

*unrelated  
to continued  
collaboration*

#### Facilities

Computers and observatories are the centers of the LodeStar facilities.

## Computers

LodeStar funds have been used to purchase computers on three occasions. Early in the project five Pentium 100MHz computers were purchased. These were installed in the LodeStar Lab, in the Etscorn Campus Observatory, in the Optics Lab, and in an office occupied by graduate students supported by LodeStar. These have become workhorses.

In late 1998 and early 1999 two additional computers were purchased, one for the telescope at the Etscorn Campus Observatory and one for the LodeStar Lab. These have allowed for remote control of the telescope at the observatory and, thus, initial remote observations from the lab.

In the summer of 1999 LodeStar funds were used to furnish and equip a computer lab for remote observing and image processing in the New Workman Center. Four computers, three PCs and one Apple Macintosh, have been set up and astronomical image processing software has been installed.

## Observatories

Early in the summer of 1995 LodeStar funds were used to remove the old telescopes from the Joint Observatory for Cometary Research, crated, and stored in the Tech Research Yard. The observatory was renamed the New Mexico Tech Remote Observatory. Negotiation was completed with Mr. Ed Byers to trade the old telescopes for one of his research quality telescope mounts. In the remainder of 1995, the design of the new tube for the Colgate 30-inch telescope was completed by Ruff Engineering. The funds for this part of the project were returned to LodeStar, as is described at the end of this report.

*LodeStar under.* In the summer of 1995 the telescope of the Home Galaxy Project came to the New Mexico Tech Remote Observatory. Mr. Graham Flint and his colleagues are using it to make a three-color survey of the Milky Way. Their product will be a color mural of our home galaxy.

*- I thought  
Tech. UNM  
works complet  
by Sep 99*

In the summer of 1995 New Mexico Tech moved the CCD Transit Instrument (CTI) from its site at Kitt Peak National Observatory to the Research Yard at the Tech campus. The mirror was subsequently transported to UNM in 1998. The support structure remains at Tech.

Early on, the Etscorn Campus Observatory (ECO) was used as a test and staging site for LodeStar development at Tech. After March 1998, upgrading the ECO became Tech's primary LodeStar activity. LodeStar funds were also used to purchase and install several pieces of equipment. These include two computers, a heater-cooler for the observing room, first-aid and fire-safety equipment, intrusion and fire alarms, fiber optics communications to the campus backbone, SBIG ST-6 and ST-8 CCD cameras, an SBIG spectrometer, a Software Bisque Paramount telescope mount, Software Bisque's Internet-accessible automation software The Sky, a weather station, and hardware and software to automate the roll-off roof.



The 14-inch telescope is now operable over the Internet. Work will soon be completed on the integration of the weather station and the roof control software to make it operable over the Internet as well, at which point the entire observatory will be Internet accessible.

} I thought  
work was  
completed  
in 99

In addition to work at ECO the wheelchair-accessible ramp and deck of the Schiefspiegler telescope have been upgraded with LodeStar funds.

#### Funds Returned to LodeStar

When work sped up in the fall of 1998 it became evident that there would not be enough time left before the contract between Tech and LodeStar expired to complete the re-mounting of the 30-inch Colgate telescope. Subsequently, Tech agreed to return to LodeStar the funds that would have been used to do this work.

## II. Capilla Peak Observatory Site

A significant element of the LodeStar proposal was to make resources available statewide, and by practical implementation on the Internet and world-wide-web, nationwide and worldwide. A significant component of the remotely accessible LodeStar assets was to be access to instructional and research quality telescopes for students, as well as professional, use. The motivation for remote access to LodeStar, and other, telescopes has several factors:

- Professional astronomers now routinely rely on remote access to telescopes for observing at telescopes located around the world. The LodeStar proposal would have allowed development of web-based telescope control, allowing a uniform user interface across telescopes of virtually any type. Thus, with web-based access, astronomers could tailor their user interface to be the same independent of whether they were using a LodeStar optical telescope at Enchanted Skies Park, an optical telescope in Hawaii, or a radio telescope in Australia.
- Robust remote control of LodeStar telescopes at Enchanted Skies Park would have ensured that partner universities would have access to the telescopes in which they invested. The demonstration of this capability required a testbed operation on which LodeStar could develop remote observing capability and demonstrate it to colleagues at other universities, observatories and agencies.
- This same control structure would allow LodeStar educators to design and implement grade-specific interfaces for web-based classroom use. An example is that a web page could be designed for, say, third grade use, that would only incorporate icons for objects currently in the sky and for which the teacher had descriptions and a curriculum segment. Thus, students in the class might point and click on the icon for Mars, say, the software would access the ephemeris for Mars and calculate a position, and the telescope would move to observe Mars.
- The data delivery system was designed to allow scientific image data to be transmitted to the professional or student user and simultaneously to other LodeStar

venues, including the LodeStar Astronomy Center and Enchanted Skies Park domed theaters. Thus, visitors would be able to see observations in progress and participate in the practice of science.

The original proposal identified production of the testbed telescope for remote observing as a task of New Mexico Tech, which was to reconstruct the 30-inch Colgate telescope and install it atop South Baldy Mountain in an existing dome. The site was termed the Kuellmer Observatory in anticipation of funding. The telescope mount was to be refurbished, and the existing optics tested and optimized. Communications capability supporting remote observing was to be installed on South Baldy. The goal was to use the 30-inch telescope as the research-quality remotely operable telescope accessible to students.

In the spring of 1998 it became obvious to LodeStar principals that for a variety of reasons, New Mexico Tech was not making progress on the testbed facility. Therefore, LodeStar principals identified UNM's existing 24-inch telescope on Capilla Peak, about 100 km south of Albuquerque, as a legitimate alternative for the remote observing testbed facility. UNM faculty, staff and students began development of Capilla Peak as the remotely operable testbed and student accessible research-quality telescope in anticipation of the possible failure of the New Mexico Tech effort. After two years of failure to perform on this task, the New Mexico Tech contract was cancelled in the fall of 1999 and UNM fully undertook the task of providing the facility, as proposed. Δ plant

The tasks accomplished at Capilla Peak include:

- Complete refurbishment of the telescope control system.
- Cleaning the telescope and re-aluminizing the primary mirror.
- Purchasing and installing a new 1024X1024 pixel CCD camera.
- Developing new in-house capability to support remote observing, including a new shutter system for the telescope, automated liquid nitrogen fill system for the cryogenic CCD camera, a web-accessible external pan-tilt video camera, and upgraded dome hardware.
- Providing intensified autoguiding capability (externally funded).
- Developing and installing a dedicated communications link between Capilla Peak and UNM's Research Park Building 801.
- Integrating all of these systems into a single software system that operates the entire observatory (including failsafe operations) and delivers data to the user.

The remotely operable telescope testbed task has been fully implemented, as proposed. Successes of the system include:

- Remote observations from Albuquerque carried out by UNM faculty and students.
- Inclusion of the Capilla Peak Observatory in the nationwide University of California Berkeley-based Hands On Universe program of remote observing for students.
- Demonstration of the LodeStar remote observing system by operating the Capilla Peak Observatory for Paris, France.

- LodeStar and UNM have become principal organizers of the Remote Telescope Markup Language development collaboration amongst universities, observatories, national laboratories and educational institutions.

The LodeStar Project was terminated before development and implementation of the general web-based interface that would have allowed simplified use in the classroom.

### III. Interferometry at Enchanted Skies Park

Based upon discussions, workshops, retreats and collaboration dating back to 1992, the prime driver for site selection and development of an observatory site for the LodeStar Project was determined to be optical and near-infrared long-baseline interferometry. Participants in this determination included scientists and engineers from UNM, New Mexico Tech, Georgia State University, AFRL, University of Kansas and others. This conclusion was bolstered by the National Academy decadal report in astronomy (the Bahcall Report), which identified optical interferometry as a priority of the astronomical community, and recommended funding for this venture.

At the time the original LodeStar Proposal was prepared, Georgia State University (GSU) had underway an NSF- funded project to build a seven-element long-baseline interferometer with one-meter individual telescopes. Following a visit to the proposed observatory site by GSU administrators and scientists, and a return visit to Atlanta by UNM administrators and astronomers, an agreement was forged in 1993 to site the interferometer at Enchanted Skies Park (ESP). The Center for High Angular Resolution Astronomy (CHARA) interferometer array was thus included in the proposal to AFOSR for the LodeStar Project.

After extensive site testing, LodeStar scientists proposed a site on Horace Mesa in Cibola County, New Mexico as the site for an observatory associated with and supported by ESP. The principal instrument and scientific driver for the site selection was an interferometric array. The demonstration of environmental compliance required by NEPA for this site began as an Environmental Assessment in 1996. In 1997, because of the opposition of Acoma Pueblo to the proposed site on Horace Mesa, the demonstration of environmental compliance was escalated from an Environmental Assessment to an Environmental Impact Statement. Because of the protracted time scale, GSU was forced to withdraw from the collaboration under pressure of expiring grant funds. GSU ultimately implemented a five-element interferometer on Mt. Wilson in California.

*A small  
or proposal  
when was  
pay down  
scopes*

LodeStar principals continued to plan an optical interferometer, but with larger (2-m to 4-m diameter) individual telescopes. The plan of action was that other collaborators would build replicable telescopes for their own universities and institutions. This ensured cost-effective telescopes for other universities and guaranteed that array elements would be identical. These telescopes would be operated remotely from the home institution using the LodeStar remote telescope control system. The agreement accompanying each

individual telescope would be that, when scheduled, every telescope would be used as an element in the interferometer, and scientific problems would be collaboratively addressed. This remained the model for implementing optical interferometry at ESP at the time the LodeStar Project was terminated.

In 1997 New Mexico Tech formed an independent collaboration exclusive of UNM to develop an identical concept for its Magdalena Ridge Observatory on South Baldy Mountain. This was the site New Mexico Tech had originally designated for the 30-inch remotely operable telescope it was to develop as an element of the original LodeStar proposal.

*irrelevant  
to this  
report*

The University of Kansas joined the effort to build an interferometer under the above scenario and committed to participate in the first replicable telescope. An agreement between the University of Kansas and UNM was in place at the termination of the LodeStar Project. This agreement demonstrates that the interferometer development plan would probably have been successful. ? *irrelevant*

#### IV. The CCD/Transit Instrument (CTI)

The CCD/Transit Instrument (CTI) is a unique 1.8-m diameter imaging and photometric survey telescope that has no moving parts. It is instead fixed to the Earth. As the Earth rotates and the sky transits the focal plane of the telescope, several charge-coupled devices (CCDs) observing in multiple optical and near infrared bandpasses are read out at the sidereal rate. The result is a long, thin image of the night sky obtained every clear night. The geometry of the surveyed area leads to the scientific name for the survey: "A Strip Search of the Universe."

The CTI data provide an unbiased multicolor survey of everything in the surveyed area of the sky to faint limiting magnitude. Because CTI is fixed to the Earth, it repeatedly surveys the same part of the sky on successive nights. This results in even fainter images, obtained by adding data from multiple nights, but more importantly, this observing technique allows detection of variable, transient and moving objects. The scientific programs of CTI include deep surveys of the Galaxy and extragalactic space, selection of extremely rare celestial objects, and discovery of targets of opportunity, such as supernova explosions in distant galaxies.

The CTI was developed at Steward Observatory about 15 years ago and the instrument and survey technique are proven. The telescope was moved to New Mexico where LodeStar scientists and students began refurbishment with the intent of making it the first scientific instrument for the observatory at Enchanted Skies Park (ESP). The reasons for attempting to make CTI immediately operable at ESP are several:

- Data from CTI provide the best possible assessment of the astronomical conditions at the newly-commissioned observatory at ESP. Extensive research and field work was done to ensure that observing conditions at ESP are superior when compared

nationally and useful to astronomers worldwide. Confirming these conditions in a peer-reviewed scientific sense requires extensive observations made with a research telescope.

- A research telescope immediately operated at ESP would help LodeStar principals recruit scientific participation and collaboration with respect to building additional telescopes and research facilities at ESP, as proposed.
- Image data from CTI would be immediately useful for educational programs at the LodeStar Astronomy Center, at other educational venues and in classrooms.
- Data from the CTI survey could be made available to collaborators and their students for a variety of diverse scientific projects, most of which have yet to be conceived.

The refurbishment required to make CTI operable included six main development or upgrade tasks:

1. A new mosaic of focal plane arrays using the best of modern imaging devices and optimum bandpass filters.
2. A new detector mosaic support mechanism capable of rigidly supporting the focal plane and allowing it to be accurately aligned on the sky.
3. A new mechanism to tilt the telescope to the required declination.
4. Upgrading the mirror support systems to accommodate the tilt capability.
5. General refurbishment of the optical support structure.
6. Upgrading the data system to support the capabilities provided by the new focal plane mosaic.

At the time the LodeStar Project was terminated by UNM, each of these tasks had been addressed to some extent.

The scientific drivers for Task 1 were identified, and 25% of the design effort was accomplished. A 256X256 infrared array was supplied by our Sandia National Laboratory collaborators.

Task 2 was not substantively addressed, because it required substantial completion of Task 1 as a prerequisite.

Task 3, a new tilt mechanism with computer controlled vernier readout, was designed for the project by Sandia National Laboratory engineer Bob Woods. This task was 90% completed, with the constructed mechanisms undergoing laboratory testing.

Task 4 was approximately 50% completed with new air support plenum and delivery system designed and built. The axial support system remains to be designed and built. This depends in some degree on the latitude of the telescope and the desired mean observing declination.

Task 5 was approximately 75% completed. The pin joint structures were replated with silver to prevent galling and point-source welding as the structure was erected. Each threaded joint was also wrapped with Teflon tape. The external optical support structure was successfully erected using a specially developed A-frame overhead crane.

The conceptual software and hardware designs associated with Task 6 are approximately 50% completed.

Substantial progress was made on returning CTI to a fully operational state. CTI will be a scientifically useful research telescope, capable of addressing a broad spectrum of Galactic and extragalactic projects as soon as these tasks are completed. CTI data will support multiple thesis programs and will be pedagogically useful for elementary and secondary educational programs.

## LODESTAR EDUCATIONAL OUTREACH

The Lodestar Project has designed its educational program to help teachers meet the national standards in science and mathematics education as appropriate for each grade level. It strives to introduce the subjects of astronomy and space science in a way that is both meaningful and thought-provoking. Aileen O'Catherine is an education specialist with LodeStar's Education Department. She is an educator with expertise in informal astronomy education.

### *Programs at the LodeStar Astronomy Center*

#### School Group Visits

School group visits number about 12,000 students per year (fall/spring), coming mainly from New Mexico, Arizona and Texas. Teachers are given packets with educational content particular to the astronomy exhibits found at the Center. Each class is given an age-appropriate scavenger hunt sheet to complete while visiting.

#### Summer Camp

In addition to maintaining the Astronomy Center, LodeStar runs a summer camp program, titled Astronomy Odyssey. From last year's initial offering of two week-long sessions, the program has grown to nine week-long sessions, with 13 to 16 students per session. Each week focuses on a particular aspect of the science of astronomy. For example, Optics and Telescopes offers a week of learning about the science of light and its application to telescopes; students work in two groups to build their own 6-inch Dobsonian telescope. Space Explorers visits some of the most famous astronomy facilities in the southwest, such as the VLA and Apache Point observatories, with nights devoted to setting up and using telescopes, and learning about astro-photography and use of CCDs. In addition to staff, the camps are taught by local high school teachers with good astronomy knowledge, thereby enhancing their astronomy skills. Summer 2000 we served 11 students and in Summer 2001 we served 90 students. Camp is a revenue generating venture.

#### Volunteer Training

LodeStar's Education Department provides in-house training programs at the Astronomy Center. This includes training in general astronomy, night and day observing with our stock of telescopes, and training in the Center's exhibits and activities. We work with volunteers from the New Mexico Museum of Natural History, and hope to expand this program to volunteers from outside the current volunteer system.

#### Junior Volunteers

During the summer, Junior Docent training, centered on an astronomy "cart," is provided to students who then function as volunteer educators during the summer season, and whenever possible, throughout the year.

We also have approximately three high school student interns per school semester. These students are taught basic tasks in the astronomy center, how to interpret exhibits, how to interact with the public, and usually assist in Starry Nights, in-house needs, and with educational outreach.

#### JPL Ambassadors/Craig Ihde

Mr. Craig Ihde and the LodeStar Education Department have formed a partnership that allows the Astronomy Center to serve as a base where JPL outreach materials can be disseminated. Mr. Ihde conducted a talk on Planetary Exploration on Space Day 2001 (May 3) as well as conducted hands-on, interactive demonstrations for school groups and general visitors that day. He also worked with us for our special Mars event in June. He will continue as a JPL outreach ambassador at the Astronomy Center, conducting special programs several times per year.

#### *Educational Outreach Programs*

##### STScI IDEAS Grant

A NASA IDEAS grant funds Project SOAR: Student Opportunities with Astronomy Resources. At the heart of this program, students from disadvantaged Albuquerque High School, coupled with students from Rio Rancho High School, learn astronomy at the Astronomy Center in a hands-on, meaningful manner. (Albuquerque High serves a large percentage of minority students). Students earn academic credit through an intensive internship, and teach astronomy at local middle and elementary schools. These students also compete for the opportunity to serve summer internships with the Astronomy Odyssey summer camps. At the camps and throughout the school year, students are trained in hands-on astronomy activities that they in turn teach to younger students at elementary and middle schools. These younger students are specifically targeted so that underserved populations can be reached. Summer 2001, we hired three student interns, two from Albuquerque High, and one from Rio Rancho. The paid internships benefited the students in income, learning experience, and development of life skills.

Outreach programs to elementary, middle and secondary schools offer visits with the Starlab portable planetarium, which is geared toward different lessons for different grades; telescopes with solar filters and attendant hands-on activities; or hands-on activities conducted in individual classrooms with astronomy content matching teacher objectives. This program, run since the summer of 1998, has grown yearly, reaching over 12,000 people this past year. Many of the student populations are minority populations. Many of the targeted institutions served were in rural areas with high rates of poverty.

Outreach programs to schools and other institutions also take place evenings in order to facilitate family involvement. Star parties typically consist of a portable planetarium set up inside a facility, as well as telescopes outside for viewing celestial objects. An astronomy slide show as well as hands-on astronomy activities also take place indoors. These nights occur either as a star party devoted to the school's population, or as an astronomy component of the school's science night. In both cases, teachers are encouraged to use the hands-on activities themselves. Ms. O'Catherine oversees and



administrates this outreach program with a staff of undergraduate and graduate student employees. Again, a commitment is made so that students in less affluent and underserved areas are reached.

Teacher training workshops provide a basic introduction to astronomy and teach hands-on activities for classroom use. At appropriate levels, projects include the origin of the seasons, lunar phases, structure of the solar system, binary stars, etc. Ms. O'Catherine has conducted these four hour long workshops either alone or with the assistance of an astrophysics graduate student. One workshop took place with teachers from the New Mexico SIMSE program, which specifically targets rural northern New Mexico schools.

Join A School Partnerships allow LodeStar to partner with specific schools in the Albuquerque Public School (APS) district. Ms. O'Catherine has instituted and fostered special programs with Reginald Chavez Elementary, Washington Middle, and Albuquerque High School so that the astronomy and science content of the project can reach these student populations. As mentioned above, a special program, Project SOAR, has been instituted with Albuquerque High. We have served Washington Middle School with numerous STARLAB visits and star parties. Reginald Chavez, which is within walking distance to the astronomy center, visits frequently, and educational outreach staff visit the school regularly. Albuquerque High DECA students raised funds with a special project so that Reginald Chavez students who couldn't attend the astronomy center could do so. Each of these partner schools is comprised mainly of minority students, and serve poverty-stricken areas.

#### **Outreach Statistics Summary**

Summer 1998	260	
Fall 1998	870	
Spring 1999	8255	
<b>1998-1999 School Year</b>		<b>9,385</b>
Summer 1999	1545	
Fall 1999	5977	
Spring 2000	4919	
<b>1999-2000 School Year</b>		<b>12,441</b>
Summer 2000	701	
Fall 2000	5842	
Spring 2001	7041	
<b>2000-2001 School Year</b>		<b>13,584</b>
Summer 2001	387	
Fall 2001 To Date	5280	
<b>2001-2002 School Year To Date</b>		<b>5,667</b>
<b>Grand Total</b>	<b>41,077</b>	

## LODESTAR ASTRONOMY CENTER

### Narrative Summary

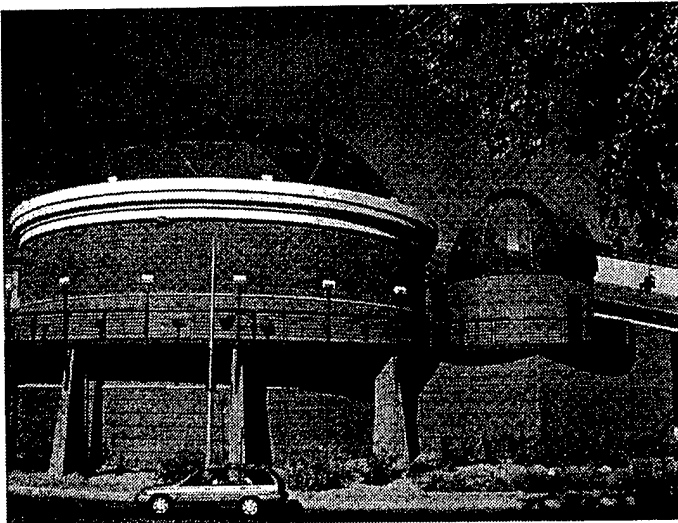
The LodeStar Astronomy Center (LAC) has been in operation at, and in partnership, with the New Mexico Museum of Natural History & Science ("Museum") in Albuquerque since December 1999. LAC programs are designed to support its astronomy-oriented informal education mission. Primary public program spaces include three exhibit galleries, a planetarium, a motion-simulation theater, an observatory, and a gift shop.

*i thought  
this was  
consolidated  
museum  
shop?*

LAC's dedicated program spaces total more than 24,000 square-feet--excluding classrooms, lecture hall, visitor service and other spaces the center shares with the Museum. LAC is also headquarters for the LodeStar Outreach program that uses LAC and Museum-shared spaces for on-site programs, as a staging area for community outreach, and for administrative duties. The Museum partnership gives LAC an effective size of 40,000 square-feet; that is, if the astronomy center was a stand-alone institution, about a 40,000 square-foot facility would be required.

LAC's capital budget was \$6.5 million for construction, remodeling, and program equipment. The Museum provided land and existing facilities valued at \$3.5 million plus a state appropriation of \$1.5 million cash to match the AFOSR grant award of \$5 million. Of the cash funds, \$3.3 million was allocated to architectural and construction work on the facility. Exhibits, planetarium equipment, observatory instruments, and other

programming and administrative equipment totaled about \$3.2 million.



The LodeStar Astronomy Center's planetarium and observatory expanded and redefined the New Mexico Museum of Natural History & Science's architecture and program.

In addition, UNM provided \$430,000 for the purchase of the motion-simulation theater equipment that LAC is reimbursing through earned revenue.

*i thought  
you used  
fed funds  
to "lease" the  
equipment*

LAC construction began in November 1998 and was substantially completed in November 1999. Facilities and programs were completed and opened in several phases between December 1999 and November 2000.

## Attendance and Impact

LAC served 274,402 school-group and general visitors in Fiscal Year 2000-01 (June 2000 – July 2001.) Of those, 176,088 experienced LAC's exhibits and/or observatory, while 98,314 visitors added planetarium and/or motion-simulation theater shows to their visit. Of all these visitors, nearly 45,000 were teachers and students coming to augment their formal education in the planetarium, motion-simulator or exhibit galleries.

In Fiscal Year 1999-2000, LAC served nearly 40,000 visitors in the motion-simulator (opened 12/1999) and planetarium (opened 3/2000.) An additional 170,000 visitors experienced LAC's first phase of exhibits (installed 12/1999.)

LAC also hosted more than 2,000 students and teachers through the LodeStar Outreach program's summer-camps and teacher open houses since LAC opened.

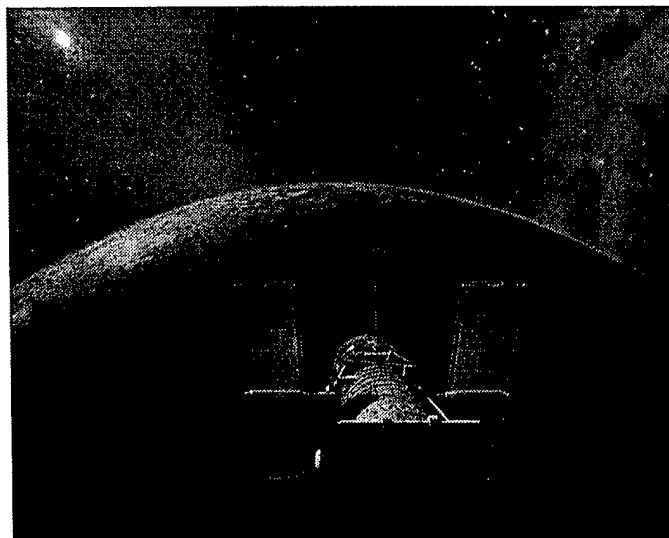
## Planetarium

The planetarium is the focal point of public astronomy education at LAC. The world-class planetarium seats 142 visitors in raked seats beneath a 55-foot diameter dome that's tilted forward 25 degrees.

The domed theater employs the most advanced projection technology available. The DigiStar II projector is a digital starfield projector that LAC uses to map the night sky in three dimensions as well as present mathematical figures such as fractals and Mobius strips. SkyVision is a mosaic projection system that creates full-dome (4750 square-feet) high-resolution digital video. Most of the imagery is created in 3D computer animation software and is unlimited in content presentation. LAC uses the system to "fly" audiences through the universe, witness astrophysical phenomena, fly into the human body, etc.

LAC offers 42 public planetarium shows each week which serve both general and school-group visitors. An additional seven shows per week are offered exclusively to school groups. The school-only shows are scheduled and presented at specific grade-levels, using New Mexico state science standards as a content measure.

The planetarium offers two types of regularly scheduled, 40-minute shows. First, "Enchanted Skies" is a star show which



LAC's planetarium technology allows visitors to explore the universe in an unforgettable manner: immersing them in 3D computer-animated images spanning the dome. Image from current show.

orients and interprets each night's sky. It is presented by a LAC staff member and allows for a dialog between the presenter and the audience so the content can be tailored to the audience's interest and knowledge levels. The second type of show is best described as a "feature show." These shows use an innovative projection system that creates digital video projections covering the entire 55-foot diameter dome; effectively making the planetarium an immersive, large-format cinema akin to OMNIMAX™.

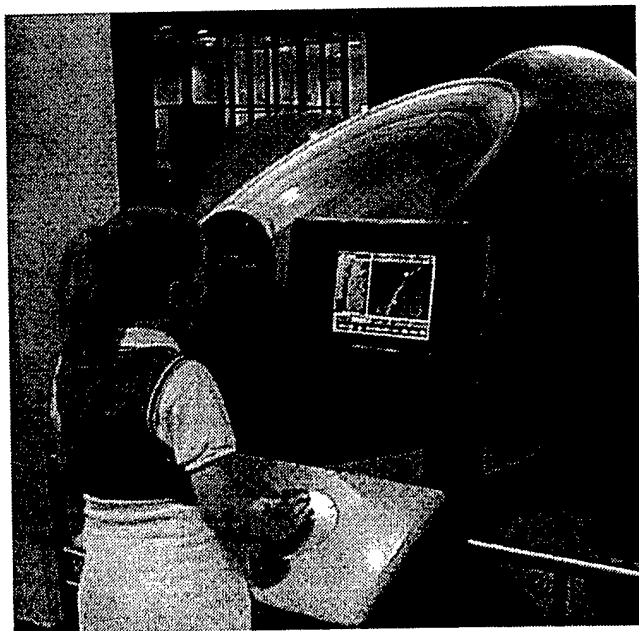
LAC has co-produced two of these feature shows to date. "Universe of Change" explores some of the dynamics of an evolving universe and our changing perceptions of the night sky. "Wonders of the Universe" takes visitors from the Big Bang to present-day Earth in a virtual tour through time and space. "Wonders" highlights the universe's early epochs, galaxy morphology, and stellar evolution.

LAC staff has begun working with faculty and students from UNM's Department of Physics & Astronomy and Department of Computer Science on a new production for the full-dome video system. The show will be on galaxies and use three-dimensional computer animations to present the scale, structure, evolution and related astrophysics of galaxies. The show is scheduled for 2003.

## Exhibits

The exhibit galleries are part of general admission to the Museum or with admission to the LodeStar planetarium or motion-simulator. On two floors, three astronomy-oriented galleries, about 40 hands-on and interpretive exhibits totaling about 9,000 square-feet, have been developed through the AFOSR grant. The galleries cover the topics of the

universe's scale and structure, tools and techniques of astronomy, and the search for extrasolar planets and life in the Milky Way Galaxy. The exhibits are detailed below.



LAC's three exhibit galleries engage visitors in astronomy through a variety of styles including models, computer kiosks, hands-on and interpretive exhibits. Solar system exhibits shown.

The JPA allows for expansion of exhibits throughout the Museum's main exhibit, the 30,000 square-foot "Time-Tracks," a historically sequenced exhibit on the natural history of New Mexico. Museum and LAC staff begun plans for a co-operative effort to update and expand the "Origins" gallery within "Time Tracks." "Origins" covers the origin of the universe, formation of the solar system, and the beginning of simple life on Earth.

*only used  
in terms of  
full consent  
JPA-museum  
is an idea  
now  
also spelled out  
as never in  
time before*

The JPA also gives LAC use of a 5,000 square-foot travelling exhibit hall. Because of the newness of the permanent exhibits, LAC has not yet taken advantage of this resource but it is a component of the five-year plan.

*LodeStar  
Upon?* Finally, the Museum partnership will allow to develop outdoor exhibits. An outdoor exhibit garden has been master planned, but funds are yet unavailable to add this program. Given New Mexico's mild climate and the subject of astronomy, this component of LAC will certainly come to fruition in the future.



The motion-simulation pods in Virtual Voyages.

### Motion-Simulation Theater

The motion-simulation theater at LAC is designed to offer high-energy learning experiences to attract junior and senior high school students who are traditionally under-served within museums and science centers.

Trademarked "Virtual Voyages," the motion simulation theater is a three-part, 15-minute experience that takes visitors along an astronomy-oriented adventure. The pre-show area begins the story using two television monitors. The "story theater" continues the adventure in a separate room using three tiled, wide-aspect monitors. The experience crescendos in the "action theater" where visitors sit in two six-seat pods that move with six-degrees of freedom. The pods move with the film presented through a large-format, rear-projected film projector.

Motion-simulators run every 15-minutes. LAC leased "Comet Impact" for the first two years of operation. The show offers unique learning opportunities about the origin, composition and flight-paths of comets as the visitors travel to Jovian space to intercept an Earth-bound comet. "Mars," a futuristic story about a manned Martian colony, will replace "Comet Impact" in December 2001.



The LodeStar Observatory provides real observing experiences that greatly enhance the planetarium, exhibit and simulator programs. The scope is used for public programs and educational workshops.

## Observatories

The LodeStar Observatory, located on LAC's second floor outdoor program space, includes a 16-inch Schmidt-Cassegrain telescope donated by Meade Corporation. The scope, controls, the observing deck, storage, and an ADA-compliant wheelchair lift are housed in a 7-meter dome. While limited by light pollution, the telescope is proving both popular and effective in observing bright celestial objects and the sun through filters. The observatory opened in November 2000.

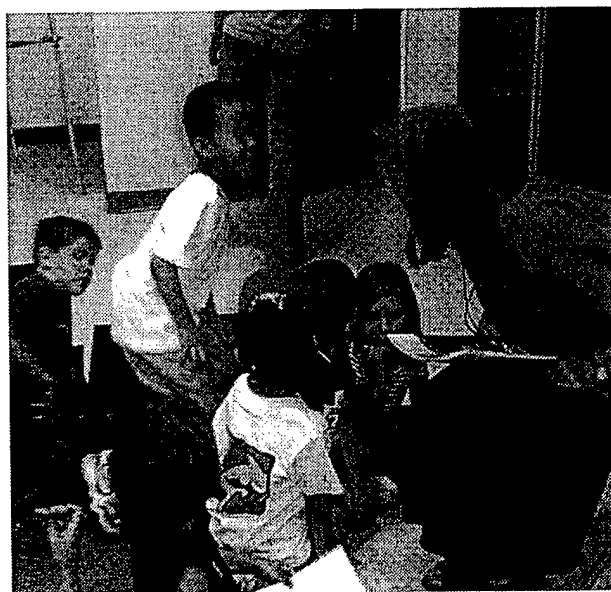
LAC observing programs include "Starry Nights," a family-oriented observing program on Saturday nights in the fall and winter. Telescope observing through the large and smaller telescopes is prefaced by the exhibits and shortened planetarium shows which introduce the night's sky and observing objects. More than 3,000 visitors attended the 17-week program between November 2000 and March 2001. The program is annual.

The observatory includes a Hydrogen-Alpha filter for solar observing. Currently the solar observing program is offered free to all Museum/LAC visitors each Sunday and by special request of school-group leaders. LAC and Outreach staff are designing a volunteer-training program to expand the solar observing program's hours.

A one-year plan includes adding the connectivity to allow LAC to serve as a remote observing site, "virtual observatory." To date, the Museum-provided Internet connections lack sufficient bandwidth to effectively run the program. A microwave link from UNM to the Museum (about three miles distant) is being planned. Both classrooms and the planetarium will serve as program space.

The virtual observatory will likely use the Capilla Peak Observatory which is also connected to UNM via a microwave system. The virtual observatory will be used primarily in teacher and student workshops, mentorship programs and in special observing events. Life-feeds into the planetarium will also enhance observing and other public evening programs.

The UNM-New Mexico Tech agreement may also provide remote access to Tech's more modest campus observatory telescope that was automated through grant funds.



The LodeStar Outreach program has served more than 34,500 students and teachers in their schools and neighborhoods since beginning in late 1998.

## **Outreach and Teacher Training at LAC**

Outreach and LAC have also hosted three teacher open-houses at the facility and collaborate on the development and delivery of pre-visit and post-visit instructional materials to more than 450 elementary, middle, and high school classrooms to date.

Two seasons of summer camps, weeklong astronomy education programs, at LAC have proven both pedagogically and financially successful. The camps on building telescopes, learning the night sky, and other astronomical themes have served more than 300 elementary and middle-school students. Sleepover programs are being designed to employ the LAC planetarium and observatory. The intensive eight-hour programs for elementary and middle-school aged children are scheduled to begin in Fall 2002.

## **Operation Budget**

Earned-revenue covered 76% of the facility's \$475,000 FY2000-01 budget—a percentage significantly higher than the national museum average of 47%. UNM subsidized the remaining portion. A fund development program was launched by LAC staff in mid-2001 and is now securing gifts and donations to develop additional programs and offset operational expenses.

LAC's economic operations are possible through the sharing of administrative and programmatic resources with the Museum through a joint powers agreement executed May 1998. The Museum, a division of the State of New Mexico's Office for Cultural Affairs, provides an estimated \$170,000 in annual operating support for LAC in the form of security, admissions, custodial, building services and utilities.

## **Programmatic Management**

The JPA ensures cooperative program development is being realized in the organizational culture of the partner institution.

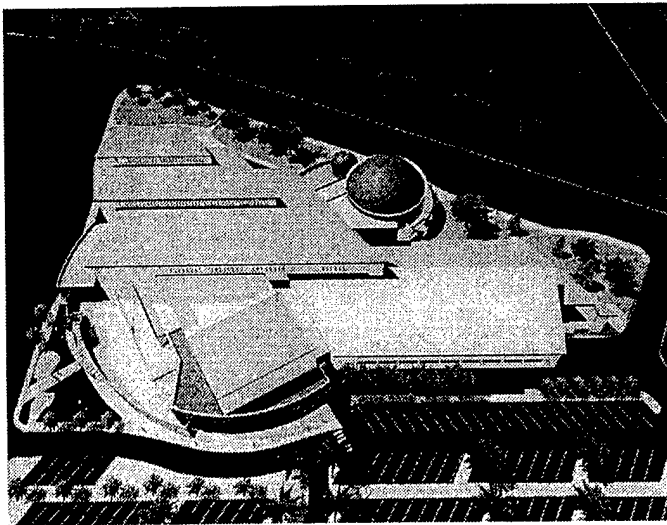
The Museum's mission of natural history and science education is proving fully compatible with LAC's mission. The LAC/Museum partnership has grown since opening to include effective cooperative educational programming and assessment activities with Museum staff as well as operational enterprises with the Museum's private not-for-profit foundation.

(LAC was originally conceived of as 'Cosmic Explora' to be operated in conjunction with the City of Albuquerque's Explora Science Center. Negotiations on that partnership ceased amicably in 1997 due to disagreements of programmatic control. Moreover, the City merged its science center with the privately operated Albuquerque Children's Museum which created a new mission incorporating art, culture, history and science that proved incompatible with LodeStar's mission of astronomy-oriented science education.)

In October 2000, LAC operations moved from under the auspices of UNM's Institute for Astrophysics (IfA) to Business & Finance Department's Office of Auxiliary Enterprises. The LodeStar Outreach program followed suit in October 2001 and now works directly with LAC for cohesive program development and delivery. IfA continues great support of LAC and outreach through programmatic content advisement, public lectures, staff training, grant-writing, mentorship support, and other invaluable efforts. IfA and LAC are currently collaborating on new planetarium shows, grant proposals, and to present Astronomy 101 courses in the planetarium.

LAC has also forged partnerships with other UNM departments, providing internships to education, technical writing, astronomy, and computer-science students. High school students participate in creating and presenting LAC programs through the outreach program's mentorship program.

The New Mexico Astronomy and Astrophysics Consortium planned in the original proposal does not exist in the formal structure envisioned. However, the main participants are active in supporting LAC and LodeStar Outreach. This informal, program-by-program relationship, has already provided win-win situations with Sandia National Laboratory, Albuquerque Public Schools, City of Albuquerque, and of course, the State of New Mexico through the Museum.



This architectural rendering of shared building after construction of LAC (top center) and Museum's new theater and entry (lower left), increasing the public program space by 35%.



## **Additional Notes on LAC:**

**Name:** The name of the center changed to the "LodeStar Astronomy Center" (from Cosmic ¡Explora!) when the partnership with the City of Albuquerque's ¡Explora! Science Center ended in 1997.

**Mission:** The LodeStar Astronomy Center is dedicated to leading people, especially young people, toward a lifetime of learning about science and nature through the compelling exhibits and programs on astronomy and related natural sciences.

**Purpose:** To introduce astronomy as a way of learning about and understanding nature and as a gateway to other sciences. To increase the science literacy and life-long learning habits in visitors and program participants. To open discovery space and meaningful learning opportunities in the people, especially the young people, of New Mexico. To develop hands-on exhibits and empowering programs for use at the astronomy center, and for lease to science centers, museums and schools on a national and international scope. To support formal education programs at all levels through outreach programs, internships, mentorships and partnerships.

**Facility:** LAC was constructed through renovation of existing Museum space and new construction. Construction began in October 1998 and substantially completed in December 1999. Construction was done in coordination with a 14,000 square-foot Museum addition of a new large-format theater, entry, and admissions area.

### Breakdown of LAC/Outreach dedicated space:

- 20,000 square-feet of indoor public programming space dedicated to LAC
- 3,500 square-feet of outdoor public programming space for LAC
- 500 square-feet astronomy-oriented retail space
- 3,000 square-feet of LAC/outreach-dedicated administrative space
- 3,000 square-feet of program support area

**Programming content:** LAC's programming focuses sharply on astronomy—describing nature, interpreting principles of astrophysics and related sciences, and introducing astronomical viewing as a rewarding activity.

LAC provides learning experiences through a carefully balanced and sequenced variety of programs. Program planning focused on different learning styles, prior knowledge, and levels of interest. The result is a facility and program that offers hands-on exhibits, immersive cinematic shows, live star-shows, real observing opportunities, lectures, camps and workshops.

Sequentially, the visitor will first experience an orientation theater, followed by hands-on exhibits that walk him/her through the universe by scale, beginning with Earth. Oriented to the scale and structure of the universe, the visitor selects to experience either a

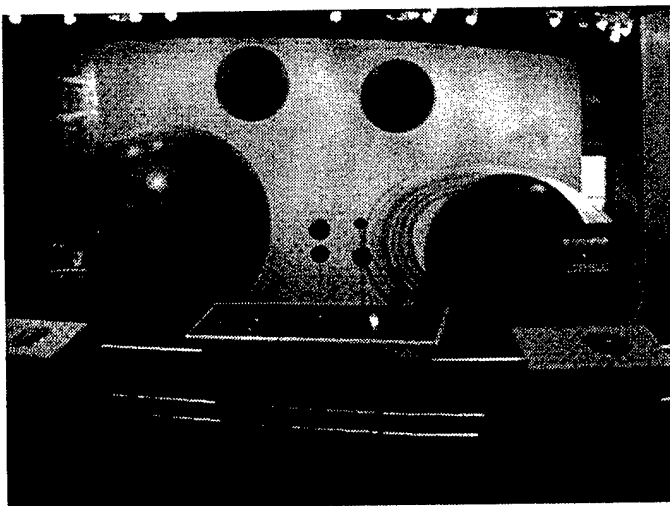
planetarium or motion-simulation theater program where additional information is gained.

During its young life, LAC has also cooperatively developed several programs with the Museum that branched out into the other natural sciences while remaining astronomy-oriented. As the partnership grows, more cross-programming will ensure effective programs that interpret astronomy in unique perspectives.

The public program spaces within LAC are:

- “Cosmic Journey,” hands-on exhibit gallery on the universe’s scale and structure
- “Tools of Astronomy” interactive exhibits about astronomy’s basic tools and techniques
- “Searching for Life” hands-on exhibit gallery on extrasolar planets and probability of and factors relating to extraterrestrial life in the Galaxy
- “LodeStar Planetarium,” a state-of-the-art digitally-based domed theater presenting live sky shows, feature shows, observing programs, lectures and special events on astronomy, related sciences and technology
- “Virtual Voyages,” a motion-simulation theater showing astronomy and natural history related programs
- “LodeStar Observatory,” a 16-inch telescope housed in a 7-meter dome for solar and night-time telescope observing. An adjacent observing deck supports smaller telescope and binocular observing.

**Management control:** LAC operates under a joint powers agreement with the State of New Mexico’s New Mexico Museum of Natural History & Science. LAC also houses and operates the LodeStar Outreach program. UNM is the fiscal agent for LAC’s programming costs (the Museum provides base visitor and facility services.) LAC’s director reports to the Associate Vice-President for Auxiliary Enterprises at UNM. LAC director coordinates programs and operations with the Museum from a de-facto senior management position.



Interactive and interpretive exhibits, on a variety of subjects afford at different intellectual levels, engage visitors hands, minds and hearts. Planet models and related computer kiosks shown here.

**Long-term commitment:** UNM has committed to the long-term operation of LAC. Also, the Museum agreed to long-term support through visitor services, security, maintenance, utilities, office spaces, etc. that have a value of approximately \$170,000 per year.

## EXHIBIT DESCRIPTIONS

### FIRST FLOOR (AKA “COSMIC JOURNEY”) EXHIBITS

#### **Basic Idea**

The first floor exhibits allow visitors to explore the scale and structure of the universe through three steps after an orientation. Where possible, the exhibits also try to assist and encourage the visitor to investigate the night sky to continue their thinking about the sizes, distances, characteristics and structure of the universe's objects.

The story is introduced with the most familiar astronomical objects, Earth and our Moon, and an orientation theater that takes visitors on a quick trip through the observable universe to spark the imagination and introduce the subject matter and story-line. The main exhibit areas are set in three basic galleries: Solar System, Milky Way Galaxy, and Universe. Each has an introductory panel and one major, iconic exhibit intended to clearly identify the gallery's subject and main idea.

Each exhibit has several layers of information available to the visitor and possible connections to other exhibits in the gallery. It is the role of the exhibit interpreter to help and encourage the visitor to delve into deeper levels of information—to levels that the visitor is comfortable addressing—and exploring the connections and interrelationships amongst the exhibits.

#### **“Introductory Graphic”**

*A Cosmic Journey in Giant Steps*

*Travel from Earth to the edge of the Universe in three fantastic leaps of scale.*

A simple graphical introduction to the exhibit story. The three graphics show the three ‘giant steps’ (Solar System, Milky Way, Universe) present the iconography and themes used in each of the main areas.

#### **“Earth-Moon Model”**

This exhibit models Earth and our moon to scale to illustrate the relative scale and distance of objects. A small telescope near the Earth model allows visitors to view the Moon model's details and help put the visitor in an ‘astronomical mind-set.’ This is the visitor's first exposure to the overall idea of expanding scales in the LodeStar Astronomy Center.

#### **“Orientation Theatre”**

An LAC-produced, four-and-one-half-minute animated show orients visitors to the topics of the exhibit hall as the visitor travels from the LodeStar Observatory at LAC through the solar system, galaxy, and universe. Presented in digital video in a 400 square-foot mini-theater.

### **“Lunar Sample and Apollo Photos”**

LAC acquired and displays a (NASA-granted, long-term loaned) lunar sample collected by New Mexico native Harrison H. Schmitt. The moon rock is evidence of the Apollo adventures 30 years ago. The photographs are examples of art meeting science. The Apollo photos were reworked by a landscape photographer and give visitors a better idea of what it was like to be on the Moon. The photos are original digital prints by photographer Michael Light from his book and traveling exhibit “Full Moon.”

## **SOLAR SYSTEM AREA**

### **Basic Idea**

The Solar System gallery offers opportunities to understand the scale and structure of the Solar System. The main exhibit is the Planet Models that shows the nine planets to relative scale—using the planetarium’s projection dome (55-feet diameter) as the Sun (the defining scale factor.) The supporting exhibits talk about the structure and dynamics within the Solar System. The Virtual Voyage’s ‘Comet Impact’ show is also related to the Solar System and discusses its structure, elements and dynamics.

### **“Solar System Intro Panel”**

A rear-illuminated graphic panel orients visitors to and introduces the scale and structure of our solar system.

### **“Planet Models and Sun Wall”**

The icon exhibit of the Solar System gallery includes models showing the size of the nine planets and what they look like from a large telescope or passing probe. Importantly, the planets are scaled using the planetarium dome (the inner, or projection, 55-ft diameter dome) as the sun. In other words, if the Sun were the size of the planetarium dome, then the planets would be this big (from about 1.5-inches diameter for Pluto to more than 4-feet diameter for Jupiter.) The sun mural behind the planets shows major surface features (sun spots, prominences, filaments and granulation) and represents about 7% of the total surface area of the Sun—when scaled. The models include interpretive graphics about each planet and the sun.

### **“Solar System Orbits”**

The exhibit illustrates the orbits of the scaled planet models relative to the state of New Mexico. The graphic shows how the planets orbit the sun in elliptical paths. When the visitor pushes a button, a rear illuminated satellite image of central New Mexico offers the orbits’ sizes relative to the scaled planet models located nearby.

### **“Tour of Planets Kiosk”**

This computer kiosk provides a basic overview of each planet—its composition, atmosphere, weather, moons and space missions related to it. Information is updated via the World Wide Web as missions and discoveries progress.

### **“Weight on Other Planets”**

Multimedia exhibit using a floor scale allows visitors to ‘fly’ through the solar system to learn what they would weigh if they were able to stand on a planet. Visitors also learn more about each planet’s size and mass as well as the planets’ order.

### **“Gravitation Station”**

The computer exhibit is a playful opportunity for visitors to investigate the basic forces found in the solar system’s motions. Visitors are asked to try to get six planets in orbit around a star.

### **“Martian Meteorite”**

UNM’s Institute of Meteoritics prepared and provided two samples of a Martian meteorite from its collection. Visitors explore one sample through a museum-style microscope by using polarizing filters to highlight the crystal structure of the sample. A larger sample is located beneath a magnifying glass for viewing the general color and other features of the sample.

## **MILKY WAY GALAXY AREA**

### **Basic Idea**

As the visitor leaves the Solar System gallery and enters the Milky Way area, he or she is taking a huge leap in scale. The exhibit introduces the visitor to the Galaxy’s size, structure and the objects that reside within it (including, of course, our Solar System.) The visitor may have been amazed by the size of the Gas Giants compared to Earth or the distances between the planets, but when the scale expands to the Galaxy level, the visitor may find the numbers of objects and distances between them mind-boggling. From an ‘interplanetary trip’ within the Solar System, the visitor moves on to an ‘interstellar trip’ of 400 billion stars separated by distances best measured in light years or parsecs, rather than miles, kilometers or ‘astronomical units.’

The main exhibit is the “Home Galaxy Theater” which is a multimedia exhibit that allows visitors to explore the structure and composition of the Galaxy as well as find our location within it. Supporting exhibits explain the number of stars, that stars have lifetimes, what exotic remnants of dead stars are like, and what’s happening in tonight’s sky—which of the Galaxy’s objects are visible.

### **“Grains of Sand”**

This exhibit tries to orient the visitor to the basic scale of our Home Galaxy. The Galaxy contains a mind-boggling 400 billion stars which is a difficult number to imagine, so the exhibit’s 7-foot tall and 28-inch diameter acrylic tube offers 400 billion grains of sand to represent the population of stars in our Galaxy. Supporting graphics try to help the visitor comprehend the vast distances between the stars by using the grain-of-sand scale.

That is, if the average star were the size of a grain of sand, then the average distance between the grains would be about 7 km (4 miles.)

### **“The Sky Tonight Kiosk”**

This computer kiosk shows what's visible in the night sky for any night in the current year (updated annually). Here, visitors can look to see what planets and constellations are visible and the Moon's phase. By 'playing' the sky map, visitors can see the changes in the sky over a period of time.

### **“Lifecycles of Stars”**

A large graphical exhibit introduces visitors to stellar evolution (birth, life, death) and remnants. The main point: Stars have life cycles; they are born, live, die and leave remnants in their death. The process is recycling and produces materials for the creation of new stars and planets. Graphics were produced in conjunction with the Space Telescope Science Institute and Anglo-Australian Observatory.

### **“Stars: A Matter of Life and Death”**

This computer kiosk allows visitors to select stars of varying mass and 'witness' what happens at the star's death. Computer animations and hypertext interpret the relationship of mass to life-spans and end-states.

### **“Black Hole”**

The exhibit is an artistic interpretation of what happens around a black hole. The exhibit is not intended to show the true physics (impossible) but simply to allow the visitor a place to consider what these exotic objects are like. Interpretive graphics and text support the kinetic model.

### **“The Home Galaxy Theatre”**

This iconic exhibit of the Galaxy Theater uses computer animation in conjunction with an old museum exhibit technique called a Pepper's Ghost. A CPU drives a large monitor and LCD projector to create a shadow theater. In the theater's viewing window, visitors see an accurate 3-D computer model of the Milky Way seemingly floating in space with local and more distant galaxies moving in the background and foreground. Using a joystick, the visitor can 'fly' around our galaxy and see it from any perspective they wish. This allows the opportunity to explore its structure. By pushing a button, the visitor can highlight where in the galaxy we are located.

The model includes all the important features of the Milky Way, its structural components known as the disk, bulge and halo, an attempt at accurate coloration of these, the spiral structure of the disk, young clusters of stars in the disk, emission nebulae where new stars are forming, dark bands of dust associated with gas between the stars, and old clusters in the halo called globular clusters. Breakout panels show space photographs of some familiar examples of these structures.

## UNIVERSE AREA

### **Basic Idea**

As the visitor leaves the Milky Way gallery and enters the Universe gallery, she or he is taking the last giant leap in scale. While the Solar System discussed planets around one sun and the Milky Way gallery talked about stars within one galaxy, the Universe area talks about galaxies as the basic building block. Galaxies gather together in ever-larger arrays to create everything we know—the observable universe.

### **“Universe Intro Panel”**

*[title] Traverse the Universe*

*[text] In the vastness of our known Universe, billions of galaxies—including the Milky Way—gather in larger and larger structures. On your odyssey, you will survey different shapes and sizes of galaxies and travel through the groups, clusters, and superclusters that they build.*

### **“Wander Through the Local Group of Galaxies”**

(colloquially known as the Galaxarium)

This icon exhibit for the Universe gallery is a fully scaled walk-in model of the assemblage of galaxies of which the Milky Way is a member - the Local Group. Three-dimensional models have been created of all the galaxies and positioned to scale as accurately as possible. Here in the dark space, visitors explore the types and sizes of individual galaxies while seeing their distances relative to their size. Panels of text explain the contents of the Local Group. Push buttons cause lighted fibers to appear which indicate some of the more important galaxies. Light-boxes on the walls depict two of the closest groups outside the Local Group (called Sculptor and Centaurus for the constellations that lie in the same direction) and the next largest structure of galaxies: the Virgo Cluster (towards the constellation Virgo).

### **“Hubble Deep Field”**

A large-format, rear-illuminated print of the famous Hubble Deep Field mosaic produced by the Hubble Space Telescope is the main exhibit. Interpretive graphics help illustrate what area of the sky the image contains, that the Universe has billions of galaxies, and that the photograph is one of the deepest photo ever taken. Visitors are also encouraged to try to find one of the oldest galaxies identified in the image.

## **TOOLS OF ASTRONOMY (SECOND FLOOR GALLERY)**

After experiencing the first floor's "Cosmic Journey" exhibits on the scale and structure of the Universe and/or experiencing a planetarium show, the visitor is well prepared to ask the question, "How do we know that?" Located outside the planetarium exit and near the observatory on the second floor, the "Tools of Astronomy" gallery is designed to introduce a few key tools and techniques of research astronomy.

### **"Intro Panel"**

A large-format graphic introduces the subject and some of the famous research observatories and their astronomical efforts.

### **"Transparent Telescopes"**

An exhibit presenting examples of a reflecting and a refracting telescope with transparent sides so visitors can see the inner workings and learn how lenses with mirrors collect the faint light of very distant objects.

### **"Color is the Key"**

Another exhibit invites visitors to look through several colored filters to see different aspects of an image, a technique astronomers use to study distant stars, planets and other celestial objects.

### **"Spectrograph"**

Visitors ignite different gases and view through diffraction gratings in an introduction to spectra and spectroscopy. A white light lamp presents the entire visible spectrum while neon, mercury, carbon dioxide and hydrogen demonstrate absorption lines in their spectra.

## **SEARCHING FOR LIFE (SECOND FLOOR GALLERY)**

### **"Intro Panel"**

A large-format graphic introduces the subject and some of the famous research observatories and current astronomical efforts.

### **"Extra-Solar Planet Scoreboard"**

A large star-map of the Northern Hemisphere locates where planets have been detected around stars. The map also includes the stars' names and magnitude as well as constellation identification. The updated exhibit also includes a large counter showing the total number of extra-solar planets detected and information on five important discoveries using our solar system as a comparison.



### **“Shifty Stars”**

An interactive model of two stars, one with a planet orbiting it, just as Earth orbits the Sun. The effect of the gravitational pull between the planet and its parent star in the model demonstrates a method scientists use to find planets so distant that they are impossible to see, even using the most powerful telescope. The pull of the planet causes the star to “wobble” off course, as it moves slightly closer to Earth at one point, and slightly further away at another. The visitor turns on lasers housed in star models’ poles to illustrate the rotation difference of the planet-bearing star.

### **“Drake Equation”**

This multimedia exhibit allows visitors to guess at the probability of intelligent life existing on other planets in our Galaxy. The exhibit titled “Are We Alone?” invites visitors to speculate about the existence of other intelligent beings. Compelling animations and narration explain some of the factors involved in the presence of intelligent life. Responses are plugged into Drake’s Equation, and the computer calculates the odds based on individuals’ answers. Visitors can compare their conclusion to other visitors’.

## ENCHANTED SKIES PARK

The Enchanted Skies Park aspect of the project was to be the first public-access park primarily dedicated to looking at and understanding the universe as seen beneath a clear, dark sky. In addition, Enchanted Skies Park would have offered a balanced program of education, research, and public outreach.

The principal activities at Enchanted Skies Park were to include:

- Presenting both daytime and evening programs on astronomy and other natural sciences;
- Providing public hands-on access to small telescopes with instruction and direction;
- Providing dark-observing stations complete with stable platforms for mounting telescopes, power, and amenities for amateur astronomers with their own telescopes;
- Sharing access with Native American tribes who wish to participate through a tribal outreach program for traditional viewing of the sky and the universe, including use of the Dark Skies Amphitheater for storytelling and naked-eye viewing of night skies;
- Conducting educational workshops;
- Sponsoring astronomy camps for children of all ages;
- Fostering and conducting astronomy-oriented research at the amateur and professional levels;
- Fostering understanding, appreciation, and respect for the natural environment and other cultures' understanding and interpretation of the earth and sky; and
- Providing trails, programs, and interpretive displays relating to astronomy, archaeoastronomy, ecology, natural history, and other sciences.

After extensive analysis, UNM selected Horace Mesa in Grants, New Mexico as its preferred site for the Enchanted Skies Park. Due to concerns expressed by Acoma Pueblo about the preferred site, it became necessary to abandon an Environmental Assessment for the proposed site and instead prepare an Environmental Impact Statement. As part of the Environmental Impact Statement effort, various alternatives to the preferred site on Horace Mesa were considered, along with a site off of Horace Mesa in Bibo.

The majority of effort in this area was related to the collection and assessment of data for the Environmental Impact Statement. The results of various surveys, tests, and analyses are summarized in the Draft Environmental Impact Statement.

Due to continuing objections to Enchanted Skies Park by Acoma Pueblo and concerns at the University of New Mexico about the financial viability of the project, the University decided to terminate this aspect of the project as of June 30, 2001.

including transport

Assoc of Nhd/Am Inds

used

not original site...

discuss ACPA in Sec 1 (Tech) & here, but not Sec 2 (Use) why?

including

given the \$ spent on this part of the project (Bibo) see a clear sum of \$25,000

## LODESTAR CHRONOLOGY

1993	Congress authorizes a \$17.5 million grant "for an astronomy-oriented science center/observatory to be located in a large urban school district with a joint power agreement by a city, regional park district, school district, and an astronomical association. Location of the center near a national laboratory with focus on teacher training and student and public programming shall all be positive evaluation factors for selection."
1993	John McGraw submits a proposal to the Air Force Office of Scientific research ("AFOSR") for Cosmic ¡Explora! on behalf of the New Mexico Astronomy Science Center Consortium: the State of New Mexico, UNM, Pueblo of Acoma, APS, USAF Phillips Laboratory, NM Tech, City of Albuquerque, SNL, and LANL.
1994	The State of New Mexico appropriates \$12 million as matching funds "to construct a highway from state road 117 to the observatory site in Cibola County...for development of an astronomy-oriented science center."
94-02-17	Martin Chavez, Mayor of the City of Albuquerque, writes Dr. McGraw in support of the proposal to create an astronomy-oriented science center in Albuquerque and assigns the "Director of the ¡Explora! Science Center to work in this cooperative endeavor and [requests] the ¡Explora! Advisory Board's assistance."
94-02-21	Dan Lopez, President of NM Tech, writes to the AFOSR that his institution is "deeply committed to the design and implementation of the programs of the Cosmic ¡Explora!"
94-02-21	Governor Reginald Pasqual of Acoma writes the AFOSR that the pueblo has passed a tribal resolution in support of Enchanted Skies Park and plans to "take an active role" in the project.
94-09-30	UNM is awarded a \$24,872,95 grant by the AFOSR for the period of September 30, 1994 through September 29, 1999, of which \$12,000,000 is the governmental share and the rest cash and in-kind matching. UNM is required to take no action that will have an adverse environmental impact until it receives written notification of compliance with the National Environmental Policy Act ("NEPA").
95-02-15	The AFOSR increases the total governmental share for the Cosmic ¡Explora! grant to \$15,800,000, which brings the total grant award to \$32,982,664 with \$5,302,594 coming from the City of Albuquerque and \$11,880,070 coming from the State. The revised environmental compliance language of the grant requires that Federal grant funds may be expended only for expenses directly related to accomplishing the Environmental Impact Analysis Process ("EIAP"); with a cap of \$500,000.
95-06-15	The AFOSR grants a categorical exclusion from further environmental analysis to the Socorro site and allows the expenditure of funds that was allocated in the original proposal for NM Tech. <i>releases associated with this portion of the project</i>
95-09-01	[Approximate date] UNM evaluates the relative merits of Mesa Gallina, Mesa Negra, and Horace Mesa for the location of ESP and determines that Horace

*see intro*

*then how did you spend \$10.1M?*

*LS identifies*

	Mesa is the preferred site for seeing the night sky. <sup>2 issues that need to be separated</sup> The original site for the project, Mesa Negra on Acoma land, is rejected because it contains a sacred site to which Acoma would want access.
96-03-01	UNM administration begins meeting with representatives of the New Vision Board, which resulted from the merger of the City of Albuquerque-owned Explora Science Center and the private Albuquerque Children's Museum, to negotiate the terms of the astronomy oriented science center in Albuquerque and to ensure adherence to the terms of the LodeStar grant.
96-05-24	President Bill Clinton issues Executive Order No. 13007 on Native American sacred sites, which requires executive agencies to "accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and...avoid adversely affecting the physical integrity of such sites."
96-08-03	As reported in the Albuquerque Journal, LodeStar and the New Vision Board continue to address several issues of contention that have arisen during the course of their protracted negotiations regarding LodeStar's participation in New Vision's proposed museum. Issues being addressed include the contractual obligations of the City of Albuquerque and the necessity for an astronomy focus to meet the requirements of the LodeStar grant. <sup>I don't care what ABC journal says, I care what happens</sup>
96-09-12	In response to formal questions presented by Congressman Joe Skeen to clarify the stance that UNM is taking with the New Vision board, the Air Force affirms that the funds appropriated for an astronomy oriented science center cannot be used for any other purpose. <sup>UNM/LS will separate from Cosmic</sup>
96-11-21	Provost Bill Gordon announces that, "Following a long series of unsuccessful negotiations between UNM and the City of Albuquerque and the Cosmic Explora! Project, I am afraid that we have now reached a point where it is time for UNM to move on to other options." Gordon states that the delays caused by the lengthy negotiations threatened the Project's funding; the parties could not agree on issues related to the proposed museum's mission and operations. <sup>Explora!</sup>
96-11-21	Lawrence Rael, Chief Administrative Officer of the City of Albuquerque, responds to Provost Gordon, "As you are aware our major concern was that the City could not agree to compromise our obligation to the tax paying public by relinquishing to Loadstar [sic] the operation authority without the financial responsibility. In any event, we accept your invitation to continue to participate in the Cosmic Explora! board and wish you the best of luck."
1997	The Air Force begins an Environmental Assessment to assess the potential environmental impacts of an astronomical observatory on Horace Mesa and contracts with Tetra Tech to perform the environmental compliance work.
Late 1997	[Estimated date] Due to Native American concerns and the deference to such concerns required by Executive Order No. 13007 and new Air Force regulations, the Air Force decides that an Environmental Impact Statement ("EIS") rather than an Environmental Assessment is needed for ESP. <sup>??</sup>
97-10-14	UNM enters into a subaward agreement with NM Tech for services NM Tech is to provide for the LodeStar project.
98-02-00	The State of New Mexico reappropriates \$12 million for the LodeStar project stating that money "shall not be expended for its original purpose but is appropriated...for infrastructure, construction, and equipping an astronomy

	science center" at ESP.
98-02-17	The Federal Register publishes the Air Force's Notice of Intent concerning the initiation of an EIS to be used to consider "whether, and under what conditions, to approve the release of federal funds to construct the observatory on Horace Mesa and to document the Air Force's decision in a Record of Decision."
98-03-30	Senator Pete Domenici writes to Head Councilman Gregory Ortiz of Acoma and asks for the pueblo's support of the LodeStar project, tries to clear up several misconceptions about the project, and warns that due to Acoma's opposition "LodeStar could fail to materialize."
98-05-11	UNM and the New Mexico Museum of Natural History and Science ("NMMNHS") execute a Joint Powers Agreement to create and develop an astronomy-oriented science center at the museum, with the NMMNHS taking the place of the City of Albuquerque's ¡Explora! Science Center.
98-06-18	The AFOSR decreases the matching fund obligation by \$182,664 because the Albuquerque Children's Museum planned to contribute \$5,182,664, while the current partner NMMNHS is contributing \$5,000,000; notes that the title of the project has been changed to LodeStar; allows expenditures at the NMMNHS and ESP for "day to day operations, A & E activities and related items, but not for construction, purchase of land, or site work until written approval by the Air Force is given for EIAP compliance"; and raises the limit on expenditures for EIAP compliance.
98-06-30	LodeStar begins its educational outreach program for elementary, middle, and secondary school students, who are introduced to a portable planetarium, hands-on science activities, and telescopes with solar filters. Other outreach activities include star parties in the evenings, in order to facilitate family involvement.
98-07-01	The initial Draft EIS for ESP is released for public comment.
98-08-05	Head Councilman Ortiz of Acoma writes to Thomas McCall, Deputy Assistant Secretary of the Air Force, about the "Tribal Council's concerns supporting the opposition" to ESP.
98-10-26	Dr. McGraw submits four alternative sites on Horace Mesa to Julia Cantrell of the Air Force Center on Environmental Excellence.
98-10-29	Groundbreaking ceremony occurs for the LodeStar Astronomy Center at the NMMNHS.
98-11-06	At the request of the AFOSR, UNM agrees to propose to descope \$5.7 million of the total governmental share of \$15.8 million, which leaves a balance of \$10.1 million in federal funds.
98-12-04	The AFOSR requires that the EIAP and the Record of Decision be completed and approved prior to exercising the \$5.7 million option; notes that since a FONSI has been issued for the Environmental Assessment of the NMMNHS, the \$5 million in federal funds designated for this site are released for expenditure; and says that the remaining \$4.166 million in federal funds have been designated for ESP "and may be used for day to day operations, A & E activities, contract services, and purchase of equipment (excluding the tram)."
98-12-18	Deputy Assistant Secretary McCall writes to Acting Provost Chris Garcia that the Air Force requires alternative sites to Horace Mesa in order to resume work on the EIS and the Section 106 consultations with Native Americans.

1) AF conducts CA @ NMMNHS  
2) FONSI  
3) release of funds

isnt  
true

How did this occur w/ no EA/CEX or C.I.S.

to the  
for the EIS

the  
EIAP is being  
a signed  
Record of  
Decision.

99-07-16	UNM requests a no-cost extension of the grant until September 29, 2000 <del>to allow additional time to complete the NM Tech work and to continue seeking environmental approval for ESP.</del>
99-07-26	The Federal Register publishes the Air Force's Notice of Intent to revise and reissue the Draft EIS for ESP and "analyze additional siting alternatives located on Horace Mesa and at a site referred to as the Bibo site."
99-09-29	After protracted negotiations between the upper administration of UNM and of NM Tech to resolve UNM's concerns about NM Tech's nonperformance with the terms of the subaward, UNM decides to terminate its subaward with NM Tech and to explore other options for meeting the remaining requirements of the LodeStar grant. <i>Project is formally realigned.</i>
99-12-21	The first phase of the LodeStar Astronomy Center opens to the public.
00-08-15	<del>Letter from UNM to the AFOSR asks for a no-cost extension of the grant until September 29, 2001 "to allow additional time to complete the [remaining] portion of the work and to continue seeking environmental approval" of ESP.</del>
00-09-25	The AFOSR states that the \$5.7 million option cannot be exercised until all actions required by NEPA are completed, including compliance with all applicable federal regulations, the EIS, and the Section 106 consultations with Native Americans.
00-12-00	The Preliminary Draft Revised EIS is issued for ESP and contains four alternatives to the preferred site on Horace Mesa, one of which is in Bibo.
01-02-28	UNM requests a four-month suspension of the environmental compliance process, so that it can reassess its plans for ESP.
Spring 2001	UNM analyzes various alternatives for ESP.
01-06-01	Acoma reaffirms its opposition to ESP in a letter to Deputy Assistant Secretary McCall and objects to UNM's request for a four-month hiatus for the EIS.
01-06-14	UNM notifies the AFOSR that it has decided to terminate the LodeStar project and not proceed with building ESP.

LS kls  
← Delo  
alternat

0354.doc

successful in n  
intent of congress  
is LAC...  
rest is in  
suppo

# ATTACHMENT 1

## Draft Final Report of the New Mexico Institute of Mining and Technology to LodeStar

David Westpfahl and Daniel Klinglesmith

Draft of November 15, 1999

### Introduction and Timeline

The New Mexico Institute of Mining and Technology (New Mexico Tech or Tech) began participating in LodeStar (or, as it was then called, Cosmic Explora) in the summer of 1993. Our initial contribution was to help with the proposal. Work on the funded proposal began in late 1994. Work continued until New Mexico Tech's President, Dr. Daniel H. Lopez, ordered work stopped in November of 1995 owing to unpaid bills. Work was restarted in January of 1997 after the bills were paid. Work continued through February of 1997 until Tech's Grants and Contracts Office ordered work stopped owing to past-due bills. Work started at a much reduced level in May of 1997. In March of 1998 a joint meeting of the UNM and Tech administrations resulted in the renewed life for Tech's role in LodeStar, thanks to the continued efforts of Dean Mike Fisher at UNM and Vice President Van Romero of NMT. After an initial project at the Etschorn Campus Observatory work sped up in the fall of 1998. With the expiration of the contract between LodeStar and Tech work stopped at the end of September, 1999.

### Accomplishments

#### Environmental Compliance and Tech's Role in the Initial Release of Funds

For practical purposes the first accomplishment was to meet with representatives of the Air Force to discuss Tech's Environmental Assessment and to request a Categorical Exclusion because all work was to be done within existing buildings. On November 9, 1994, Major Norb Diaz, JAG Officer, AFOSR, Ms. Julie Cantrell, Air Force Office for Environmental Excellence, Mr. William Dick, Air Force Office for Environmental Excellence, Dr. John McGraw, and Ms. Sharon Janecka came to the Tech campus. They met with Prof. Westpfahl, Prof. William Winn, the Director of Langmuir Laboratory, Mr. Harvey Wilds, Tech's Director of Finance, and President Lopez. They discussed the request for a categorical exclusion and the possibility of separating Tech's role in LodeStar from the roles of the other institutions so that Tech's funds might be released, allowing work to start. Tech agreed to take the lead in site testing so that the selection of a site for Enchanted Skies Park could start in a timely manner. After suitable discussions and gathering of data the paperwork for the CATEX was completed in March of 1995. Funds were released shortly afterwards and the site testing effort began.

#### Site Testing

with Albuquerque Academy and began to offer MST classes at their campus in Albuquerque.

Classes have been offered throughout the 1995 to 1999 period, some under LodeStar sponsorship and some under Tech sponsorship when Tech's President, Daniel H. Lopez, ordered work stopped.

Astronomy for Teachers was offered at Tech in the summers of 1995, 1996, and 1998, and at Albuquerque Academy in the fall of 1999. Enrollments were 7, 12, 19, and 14, respectively.

Computers and the Internet was offered at Tech in the summers of 1997, 1998, and 1999 and at Albuquerque Academy in the fall of 1998. Enrollments were 12, 18, 14, and 10, respectively.

Teaching Advanced-Placement Physics was offered at Albuquerque Academy in the spring of 1997. Enrollment was 3.

Tech's graduate classes benefited from the use of LodeStar computers and from the upgrades to the Etscorn Campus Observatory (see below). Physics 565, Astronomical Techniques, was offered in the fall of 1995, 1997, and 1999. The students in these classes performed several of the upgrades, including installation of the new automated mount and testing of the CCD camera. Physics 566, Advanced Radio Astronomy, was offered in the spring of 1994, 1996, and 1998. These classes made extensive use of the LodeStar computers. Physics 571, Modern Optics, made extensive use of the LodeStar computer and CCD camera in the optics lab.

Several graduate students used LodeStar facilities in their thesis work, some received LodeStar financial support. The beneficiaries are listed below.

#### Graduate Students Supported

Master of Science - Thomas Tongue, Margaret Graham, Jordan Alexander, Bruce Nemitz, Denis Oesch (to finish December, 1999), Howard Beckley (to finish December, 1999), Katrina Koski (to finish May, 2000)

Master of Science Teaching - Bruce Smith, Barry Winters, Cindy Schenke, Martha Dyer, Hank Starr, Apurna Joshi, Paula Rogan, Phyllis Kempter (to finish in May, 2000), Rich Salaz (to finish in May, 2000)

Doctor of Philosophy - Alison Peck, Paul Arendt (to finish May, 2000)

#### Faculty Involvement and Minority Faculty Development



quality telescope mounts. In the remainder of 1995 the design of the new tube for the Colgate 30-inch telescope was completed by Ruff Engineering. Owing to the work stoppage from November 1995 to January 1997 and the subsequent difficulties from February of 1997 to March of 1998 there was not enough time left to complete the Colgate telescope. The funds for this part of the project were returned to LodeStar, this is described at the end of this report.

In the summer of 1995 the telescope of the Home Galaxy Project came to the New Mexico Tech Remote Observatory. Mr. Graham Flint and his colleagues are using it to make a three-color survey of the Milky Way. Their product will be a color mural of our home galaxy.

In the summer of 1995 New Mexico Tech moved the CCD Transit Instrument (CTI) from its site at Kitt Peak National Observatory to the Research Yard at the Tech campus. The mirror was subsequently transported to UNM in 1998. The support structure remains at Tech.

Before the 1995-1997 work stoppage the Etscorn Campus Observatory (ECO) was used as a test and staging site for LodeStar development at Tech. After work resumed in March of 1998 upgrading the ECO became our primary LodeStar activity. LodeStar funds have been used to purchase and install several pieces of equipment. These include two computers, a heater-cooler for the observing room, first-aid and fire-safety equipment, intrusion and fire alarms, fiber optics communications to the campus backbone, SBIG ST-6 and ST-8 CCD cameras, an SBIG spectrometer, a Software Bisque Paramount telescope mount, Software Bisque's Internet-accessible automation software The Sky, a weather station, and hardware and software to automate the roll-off roof.

The 14-inch telescope is now operable over the Internet. Work will soon be completed on the integration of the weather station and the roof control software to make it operable over the Internet as well, at which point the entire observatory will be Internet accessible.

In addition to work at ECO the wheelchair-accessible ramp and deck of the Schiefspiegler telescope have been upgraded with LodeStar funds.

#### Funds Returned to LodeStar

When work sped up in the fall of 1998 it became evident that there would not be enough time left before the contract between Tech and LodeStar expired to complete the re-mounting of the 30-inch Colgate telescope. Subsequently, Tech agreed to return to LodeStar the funds that would have been used to do this work.

## ATTACHMENT NO. 2

### ENCHANTED SKIES PARK

The Enchanted Skies Park aspect of the project was to be the first public-access park primarily dedicated to looking at and understanding the universe as seen beneath a clear, dark sky. In addition, Enchanted Skies Park would have offered a balanced program of education, research, and public outreach.

The principal activities at Enchanted Skies Park were to include:

- Presenting both daytime and evening programs on astronomy and other natural sciences;
- Providing public hands-on access to small telescopes with instruction and direction;
- Providing dark-observing stations complete with stable platforms for mounting telescopes, power, and amenities for amateur astronomers with their own telescopes;
- Sharing access with Native American tribes who wish to participate through a tribal outreach program for traditional viewing of the sky and the universe, including use of the Dark Skies Amphitheater for storytelling and naked-eye viewing of night skies;
- Conducting educational workshops;
- Sponsoring astronomy camps for children of all ages;
- Fostering and conducting astronomy-oriented research at the amateur and professional levels;
- Fostering understanding, appreciation, and respect for the natural environment and other cultures' understanding and interpretation of the earth and sky; and
- Providing trails, programs, and interpretive displays relating to astronomy, archaeoastronomy, ecology, natural history, and other sciences.

In the original proposal this facility was to be sited on Mesa Negra, but the preferred site for the facility was changed to Horace Mesa because site testing showed Horace Mesa to be a better astronomical site. As well, at that time, Horace Mesa was purported to be the preferred site for the facility by Native Americans.

However, due to concerns expressed first by Acoma Pueblo and later by other Native American groups about the preferred site, it became necessary to abandon an Environmental Assessment for the proposed site and instead prepare an Environmental Impact Statement (EIS). As part of the Environmental Impact Statement effort, various alternatives to the preferred site on Horace Mesa were considered, along with a site off of Horace Mesa in Bibo. The sites and alternatives that were finally included in the EIS were:

1. Proposed Action (Golf Course with Research Area). The ESP would have been built on the northwest corner of Horace Mesa. The facility would have consisted of a Sun Plaza at the base of the mesa, a Star Center on the mesa and an astronomy research center, also on the mesa. The Sun Plaza would have been

connected to the Star Center via a tram. A road to connect the Star Center to the research area would have been constructed.

2. Alternate A (Golf Course without Research Area). This is the same as the Proposed Action but without the research area. This would have eliminated construction of a research facility and the road connecting it to the Star Center.
3. Alternate B (Exit 89 with Research Area). In this case the ESP would have been immediately west of the southern tip of Horace Mesa. The Sun Plaza was to be located at the base of Horace Mesa near Exit 89 with the Star Center on the top of the mesa. The research area would have been constructed on the southern tip of Horace Mesa approximately three mile from the Star Center. An access road would have connected the sites on top of the mesa. As in the Proposed Action, a tram would have connected the Star Center to the Sun Plaza.
4. Alternate C (Exit 89 without Research Area). This would have been the same as Alternate B excluding the research area and access road.
5. Alternate D (Bibo Site) In this case ESP would have been constructed on the Mesa Chivato on the western edge of Bear Canyon. As before, the Star Center would have located on the mesa with the Sun Plaza at the base of the mesa. The two would have been connected by a tram. The research area would have been at one of three possible locations.

Although there were some differences among the plans for construction at the three distinct geographical locations necessitated by the topography of the sites, the overall plans were substantially the same. Important differences related to the proposed construction included the sources of water and facilities for sewage treatment. These sites were chosen based upon several important criteria. The first and foremost criteria were that the sites had to be in Cibola County. This was a condition attached to the matching funds.

The majority of effort in this area was related to the collection and assessment of data for the EIS and the surveys necessary to choose sites with optimal viewing conditions for the educational mission and research facilities where appropriate. In order to perform many of the surveys and provide the data necessary for the EIS, fairly complete architectural drawings of the proposed facility had to be obtained as well as estimates of the number of visitors. At the termination of this project, the architectural drawings in the possession of UNM were estimated to be approximately 70% of those needed for construction. In addition, a business plan had been commissioned and delivered. Unfortunately, careful analysis of this plan indicated that it was severely flawed, which was one of the contributing factors to the decision to terminate the program. Even without the complications of the EIS, a number of other factors had to be considered. These included the availability of sufficient water, plans for waste treatment, access during and after construction, and availability of the necessary land.

The studies necessary to complete the EIS brought with them a number of lengthy and detailed studies of the impact of the proposed facility on the physical, cultural, and socioeconomic environment. Many of these required securing the services of experts in a particular area. First, base lines had to be established for transportation, land resources,

visual resources, geology and soils, water resources, air quality and acoustics, cultural and paleontological resources, biological resources, socioeconomic conditions, and environmental justice. Once these measurements were completed, the consequences of the construction and operation of the facility in each of these areas had to be ascertained. This was both a lengthy and expensive proposition.

Due to continuing objections to Enchanted Skies Park by Acoma Pueblo and other Native American groups and concerns at the University of New Mexico about the financial viability of the project, the University decided to terminate this aspect of the project as of June 30, 2001. At the time of the termination, a draft EIS had been prepared and was about to be circulated to interested parties for comment.

### ATTACHMENT NO. 3

#### GENERAL SUMMARY

Although the University of New Mexico was unable to complete all aspects of the LodeStar project, there are a number of successes that can and should be attributed to this project. The LodeStar Astronomy Center at the New Mexico Museum of Natural History and Science is complete and operational. Although there are still issues that need to be worked out, it is fulfilling one of the key components of the original proposal, to provide an educational astronomy-oriented science experience to students in New Mexico. Under the direction of David Beining, the LAC is developing new programs and exhibits as well as continuing the successful outreach program that was initiated under the LodeStar project. The outreach program is another of the success stories of the project. The preliminary numbers for this year indicate that this program will again bring astronomy to approximately 12,000 students throughout the state, many of them from under represented groups. In fact, this program is deemed to be so successful that the University administration is exploring ways to broaden the program to include other areas of science such as ecology and geology.

Another positive outcome of this project was the development of the hardware and software necessary to remotely control a telescope. The telescope at Capilla Peak Observatory can now be controlled through the web. Future plans call for it to be used as part of the educational facilities at LAC.

Even though we were unable to complete Enchanted Skies Park, we still believe that the original concept was innovative and represented a new way to think about how to educate adults about science and attract children to careers in science and engineering. Certainly, one of the critical problems facing this nation is the projected shortage of scientists and engineers in the future and the relatively small number of people in these professions from under represented groups. This project provided a new way to think about solving this problem. Unfortunately, this portion of the project could not be completed. The project as originally proposed did not envision a lengthy environmental process; thus this expense was not part of the original budget. At the time of the termination, the amount of money remaining for construction was marginal. In addition, a careful analysis of the business plan indicated that it was flawed and that Enchanted Skies Park, if opened, would have operated at a considerable loss for many years. Finally, the continued concerns of several Native American groups made it very unlikely that a favorable decision would have been forthcoming on the Environmental Impact Statement.

The direct outcome of the Enchanted Skies Park portion of the project was a reassessment of the way in which UNM manages and evaluates this type of project. New projects of this magnitude and complexity will operate under entirely different management procedures. In addition, new procedures for assessing potential problems while the project is still in the proposal stage are being developed.

## FACT SHEET

SUBJECT: LodeStar

Date:

QUESTION: Staffers in Sen Hutchison's (R-TX) office are interested in the LodeStar Telescope Project. They have heard that there was a \$5.7M grant for the University of New Mexico (UNM) to install a telescope for this project in New Mexico, but that environmental impacts precluded installation at the desired location and the project is now stalled. They have been informed that after discussions with the Director of the McDonald Observatory in Texas, the Project Manager believes the telescope could be installed in Texas and still accomplish the goals of this project. Specifically, they would like to know what is the current status of the dollars appropriated for this telescope installation?

ANSWER: Congress did not appropriate funds specifically for the LodeStar Telescope Project. However, in FY93, Congress did add \$17.5M to PE 0601102F, Defense Research Sciences, for an Astronomy-Oriented Science Center (AOSC) to be constructed in connection with a large metropolitan school district where math and science test scores were below national norms.

In response to this Congressional Add, the Air Force Office of Scientific Research (AFOSR) ultimately awarded two AOSC grants. The \$17.5M Congressional Add was let on a grant to the Chabot Observatory and Science Center (COSC) in Oakland, California. In addition, a \$15.8M grant, funded from within AFOSR core program funds, was awarded to the UNM-led LodeStar consortium to build an AOSC at three locations in New Mexico -- an Astronomy Center and Planetarium in Albuquerque, a remote telescope and teacher development center in Socorro, and an Enchanted Skies Park (ESP) and Observatory in Cibola County.

Both grants have since been closed out. The COSC grant was completed in 1999, all funds were expended, and the facilities opened in December 1999. The UNM-led LodeStar grant, however, was modified and extended when the ESP and Observatory portion of the effort ran into environmental impact issues. Of the \$15.8M LodeStar grant, \$10.1M was expended on the Albuquerque and Socorro portions of the effort, which were completed in December 2000 and September 1999, respectively. The remaining \$5.7M targeted for the ESP and Observatory was put on a grant option pending completion of the Environmental Impact Statement and resolution of issues identified.

UNM subsequently requested that the LodeStar grant be closed out without exercise of the \$5.7M option. This was done on 30 June 2001 and the \$5.7M in AFOSR core funding was released to other AFOSR core programs for execution.

QUESTION: What actions can/should Congress take to facilitate the bed down of this telescope in Texas?

ANSWER: As noted above, the Air Force has completed all actions related to the two AOSC grants and both grants have been closed out. The \$5.7M in question came from within AFOSR core program funding and was returned for execution on core programs when UNM requested the grant be closed out without exercise of the ESP and Observatory option. Any subsequent activity to support efforts related to the UNM-LodeStar program, whether in New Mexico or in Texas, would require new Congressional authorization, new appropriations, and new funding agreements.



**The University of New Mexico**

Contract and Grant Accounting  
Scholes Hall, Room 206  
Albuquerque, NM 87131-3106  
Telephone (505) 277-4721  
FAX (505) 277-8567

**NOV 27 2001**

AFOSR/PK2  
USAF, AFRL  
801 North Randolph Street, Room 732  
Arlington, VA 22203-1977

Attn: Ms. Rebecca C. Applebaugh

Your Ref: F49620-94-1-0425  
Our Ref: 3-43321-3

Dear Ms. Applebaugh:

Enclosed please find the following documents for the above referenced grant.

SF 269 for the period 07/1/94 through 06/30/2001 and  
Final Report of Inventions (DD Form 882)

Should you have any questions or if you require additional information, please contact Joyce Witte-Wicklund at this office.

Sincerely,

Mike Schwantes  
Accounting Manager  
Contract & Grant Accounting  
(505) 277-4721

Enclosures



**THE UNIVERSITY OF NEW MEXICO**

CONTRACT AND GRANT ACCOUNTING

SCHOLES HALL, RM 206

ALBUQUERQUE, NM 87131-3106

PHONE (505) 277-4721

**AIR FORCE OFFICE OF SCIENTIFIC RESEARCH**

ATTN: BECKY APPLEBAUGH

110 DUNCAN AVENUE SUITE B115

BOLLING AFB, DC 20332-0001

Reference No: F49620-94-1-0425

Expenditures for 09/30/94 through 06/30/01

Prepared 11/14/2001

Detail of Final SF 269

<u>DESCRIPTION</u>	<b>CUMULATIVE</b>		
	<u>Recipient Share of Outlays</u>	<u>Federal Share of Outlays</u>	<u>Total Outlays</u>
SALARIES, WAGES & FB	\$ 790,726.13	\$ 1,756,165.20	\$ 2,546,891.33
MATERIALS & SERVICES	2,634,890.55	1,606,899.70	4,241,790.25
TRAVEL	6,574.07	86,811.40	93,385.47
EQUIPMENT	30,490.97	1,825,124.12	1,855,615.09
NM TECH SUBCONTRACT	51,680.00	341,438.05	393,118.05
NM MUSEUM NATL HIST		3,709,110.09	3,709,110.09
INDIRECT COST		774,451.44	774,451.44
NMMNH&S CASH COST SHARE	1,408,220.00		1,408,220.00
NMMNH&S IN-KIND COST SHARE	3,591,887.00		3,591,887.00
10.b. Recipient share of outlays	<u>\$ 8,514,468.72</u>		
10.c. Federal share of outlays		<u>\$ 10,100,000.00</u>	
10.a. Total outlays			<u>\$ 18,614,468.72</u>

# THE UNIVERSITY OF NEW MEXICO

CONTRACT AND GRANT ACCOUNTING

SCHOLES HALL, RM 206

ALBUQUERQUE, NM 87131-3106

PHONE (505) 277-4721

## CUMULATIVE

	<u>Federal Share of Outlays</u>
FACULTY SALARIES	293,137.47
RA SALARIES & TUITION	245,600.75
SUPPORT STAFF SALARY	155,127.03
TECHNICIAN SALARY	63,553.45
STUDENT SALARY	70,900.97
ADMIN/PROF SALARY	660,137.66
PAYROLL BENEFITS	267,707.87
<b>SUBTOTAL SAL/WAGES/BENEFITS</b>	<b><u>1,756,165.20</u></b>
MATERIALS & SERVICES	182,756.79
ABQ CHILDRENS MUSEUM	15,000.00
NMERI SERVICE	22,086.15
CSA ENGINEERING	7,537.29
UNM TEMP SERV	70,754.11
COMPUTER SUPPLIES	35,046.39
COMPUTER MAINT	24,795.22
TELEPHONE CHARGES	46,124.54
FREIGHT	5,604.51
POSTAGE	13,750.34
NONCAPITAL EQUIPMENT	81,124.24
STUDENT/PARTICIPATION	22,894.40
CONSULTANT HONORARIUM	13,397.79
CONSULTANT TRAVEL	1,944.64
SURVEYS AND TESTING	5,338.00
RENTS/LEASES/	108.56
EQUIPMNT MAINT	98.50
PROFESSIONAL SVC'S MISC	213,425.43
POMPEA & ASSO	78,397.04
HEISER & ASSO	152,213.07
TETRA TECH-EIS	122,607.87
LEGAL SERVICE	5,944.10
ARCH/ENGR SER	5,728.95
MAHLMAN MILES ARCH & ENGR	299,932.25
DCSW ARCH & ENGR	14,898.82
SVS ARCH & ENGR	165,390.70
<b>SUBTOTAL MAT'L/SERVICES</b>	<b><u>1,606,899.70</u></b>
TRAVEL	86,811.40
<b>SUBTOTAL TRAVEL/TRANSP</b>	<b><u>86,811.40</u></b>
EQUIPMENT	1,825,124.12
<b>SUBTOTAL EQUIPMENT</b>	<b><u>1,825,124.12</u></b>
NM TECH	341,438.05
NM MUSEUM NAT'L HISTORY	3,709,110.09
<b>SUBTOTAL CONTRACT SERV</b>	<b><u>4,050,548.14</u></b>
INDIRECT COST	<u>774,451.44</u>
<b>TOTAL EXPENSE</b>	<b><u>10,100,000.00</u></b>

THE UNIVERSITY OF NEW MEXICO  
CONTRACT AND GRANT ACCOUNTING  
SCHOLLS HALL, RM 206  
ALBUQUERQUE, NM 87131-3106  
PHONE (505) 277-4721

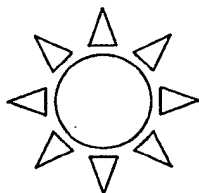
**CUMULATIVE**  
**Recipient Share of Outlays**

FACULTY SALARIES	89,902.22
RA SALARIES & TUITION	134,688.86
SUPPORT STAFF SALARY	81,367.17
TECHNICIAN SALARY	35,468.52
STUDENT SALARY	18,170.83
ADMIN/PROF SLARY	305,037.98
PAYROLL BENEFITS	126,090.55
<b>SUBTOTAL SAL/WAGES/BENEFITS</b>	<b>790,726.13</b>
MATERIALS & SERVICES	84,339.86
PROFESSIONAL SVC'S MISC	15,494.68
HEISER & ASSO	686,191.16
TETRA TECH-EIS	951,642.16
LEGAL SERVICE	893.50
ARCH/ENGR SER	82,788.45
MAHLMAN MILES ARCH & ENGR	740,181.30
DCSW ARCH & ENGR	67,702.30
BLDG SPACE & RENTAL	5,657.14
<b>SUBTOTAL MAT'L/SUPPLIES</b>	<b>2,634,890.55</b>
TRAVEL	6,574.07
<b>SUBTOTAL TRAVEL/TRANSP</b>	<b>6,574.07</b>
EQUIPMENT	1,438,710.97
<b>SUBTOTAL EQUIPMENT</b>	<b>1,438,710.97</b>
NM Tech Paid By UNM	51,680.00
<b>SUBTOTAL CONTRACT SERV</b>	<b>51,680.00</b>
<b>Total In-kind Certified BY NMMNH&amp;S</b>	<b>3,591,887.00</b>
<b>TOTAL EXPENDITURES</b>	<b>8,514,468.72</b>

*info & report  
is this?  
does this incl football  
tickets*

Source Of Cost Share	
NMMNH&S Cash	1,408,220.00
NMMNH&S In-Kind	3,591,887.00
NMSH&TD	3,462,681.72
UNM	51,680.00
<b>TOTAL COST SHARE</b>	<b>8,514,468.72</b>

THE UNIVERSITY  
OF  
NEW MEXICO



CONTRACT AND GRANT ACCOUNTING  
SCHOLES HALL, ROOM 206  
ALBUQUERQUE, NM 87131-3106

FAXFAXFAXFAXFAXFAXFAXFAXFAXFAX

Date: January 4, 2002

Number of pages including cover sheet 6

To:

Becky Applebaugh, Contracting Officer  
AFOSR/PK2

Phone: 703-696-5979

Fax Phone: 703-696-9733

CC: \_\_\_\_\_

From:

Joyce I. Witte-Wicklund, CPA  
Supervisor of Accounting

Phone: (505)277-4604

Fax Phone: (505)277-8567

email: jwick@unm.edu

REMARKS:    ☐ Urgent    ☐ For Your Review    ☐ Reply ASAP    ☐ Please Comment

Following document copies provided per your request:

- 1) Form CASB DS-2 Item 2.5.0 - 2.7.0 disclosing Direct Fringe Benefit Costs
- 2) UNM Human Resources Benefits Summary - identifying "Discounted Services" including discounted admission tickets for athletic and theater entertainment.

COST ACCOUNTING STANDARDS BOARD DISCLOSURE STATEMENT REQUIRED BY PUBLIC LAW 100-679 EDUCATIONAL INSTITUTIONS		CONTINUATION SHEET PART II--DIRECT COSTS NAME OF REPORTING UNIT THE UNIVERSITY OF NEW MEXICO
Item No.	Item Description	
2.5.0	<p><i>Method of Charging Direct Salaries and Wages (continued)</i></p> <p>3) Effort certification:</p> <ul style="list-style-type: none"> <li>a) For non-exempt employees paid against sponsored programs <u>and</u> for the faculty, staff and student employees of designated major research centers, the accuracy and appropriateness of labor charges are confirmed by the department when timesheets are approved.</li> <li>b) For exempt employees paid against sponsored programs, the accuracy and appropriateness of labor charges are confirmed by after-the-fact certification.</li> <li>c) For housestaff, the accuracy and appropriateness of labor charges are confirmed by the Graduate Medical Education Department.</li> </ul>	
2.5.2	<p><i>Salary and Wage Cost Accumulation System</i></p> <p>Employee salaries and wages are accumulated in the University's computerized subsidiary Human Resources System (HRS). Salary and wage allocations encompass sponsored, instructional and other objectives on an integrated basis as discussed in Section 2.5.0. HRS data is incorporated into the University's Financial Reporting System (FRS) electronically by account and subcode. Effort certification by responsible persons confirms proper allocation of direct charges to sponsored projects. Labor costs are confirmed by department reconciliation of HRS to FRS. Currently departments are provided two reports to facilitate reconciliation of proper allocation of labor costs: 1) payroll and payroll distribution reports (HRS) which detail labor costs and fringe benefit charges by account number and employee (totals are provided by employee, subcode and entire account number), and 2) report of transactions (FRS) which provides the total amount of salary and fringe benefit expense by subcode.</p>	
2.6.0	<p><i>Description of Direct Fringe Benefit Costs</i></p> <p>Direct fringe benefit costs include compensated leave, mandated benefits, insurance and other benefits</p> <p>Compensated Leave:</p> <ul style="list-style-type: none"> <li>1) annual leave</li> <li>2) sick leave for time off due to personal or family illness (may be supplemented by catastrophic leave)</li> <li>3) holiday pay</li> <li>4) military leave while on certain types of active duty</li> <li>5) miscellaneous (University closure, marriage, bereavement, voting, jury duty, professional, administrative)</li> <li>6) sabbatical</li> </ul>	

COST ACCOUNTING STANDARDS BOARD DISCLOSURE STATEMENT REQUIRED BY PUBLIC LAW 100-679 EDUCATIONAL INSTITUTIONS		CONTINUATION SHEET PART II--DIRECT COSTS NAME OF REPORTING UNIT THE UNIVERSITY OF NEW MEXICO
Item No.	Item Description	
2.6.0	<p><i>Description of Direct Fringe Benefit Costs (continued)</i></p> <p>Mandated Benefits:</p> <ol style="list-style-type: none"> <li>1) FICA/Medicare in accordance with Federal provision</li> <li>2) Workers compensation covers injury or illness arising from and in the course of employment pursuant to the laws of the State of New Mexico</li> <li>3) Unemployment in accordance with New Mexico Unemployment Compensation Act</li> <li>4) Retirement provided by:             <ol style="list-style-type: none"> <li>a) New Mexico Educational Retirement Board, a qualified defined benefit plan. Employees of the University are covered by a legislative non-negotiated retirement plan through the Educational Retirement Act (ERA) of the State of New Mexico, as a cost-sharing multiple employer public employee retirement system.</li> <li>b) Alternative Retirement Plan, administered by commercial businesses selected by the state legislature, is available to faculty and certain professionals. This is a defined contribution plan which requires employer and employee contributions at rates established on an annual basis.</li> </ol> </li> </ol> <p>Insurance - The University contributes partial premium payments for eligible employees plus dependent coverage:</p> <ol style="list-style-type: none"> <li>1) health indemnity and HMO options;</li> <li>2) dental indemnity and prepaid plans;</li> <li>3) term life;</li> <li>4) long-term disability;</li> <li>5) professional liability.</li> </ol> <p>Other:</p> <ol style="list-style-type: none"> <li>1) <u>employee discounts on athletic and fine arts events</u></li> <li>2) employee tuition remission for qualified undergraduate, graduate or professional academic credit and work-related noncredit courses</li> <li>3) Employee Occupational Health Service provides on-the-job illness and injury care and job-required immunization and medical tests</li> <li>4) Counseling, Assistance and Referral Service provides short-term job and personal counseling, referrals to outside resources, mediation services, workshops, and drug-free workplace training</li> <li>5) sick leave payout above internally-designated level</li> </ol>	

Note →

COST ACCOUNTING STANDARDS BOARD DISCLOSURE STATEMENT REQUIRED BY PUBLIC LAW 100-679 EDUCATIONAL INSTITUTIONS		PART II--DIRECT COSTS NAME OF REPORTING UNIT THE UNIVERSITY OF NEW MEXICO
Item No.	Item Description	
2.6.1	<p>Method of Charging Direct Fringe Benefits</p> <p>The University uses a fringe benefit rate for estimating direct fringe benefit costs in grant applications and contract proposals. <u>Fringe benefits are charged to the same cost objectives as their associated salaries and wages.</u> Compensated leave is charged to sponsored agreements as follows:</p> <p>In general, when leave is taken by eligible employees, actual costs of compensated absences are directly charged to salaries and wages. At separation, employees are entitled to payment of unused annual leave up to limits established by University policy.</p> <p>However, designated large research centers are assessed a rate for the compensated leave and associated fringe benefits of their employees. Assessments are held in a liability account which is subsequently charged when leave is taken. The account balance is rolled forward and the rate is reviewed annually. See chart at 2.4.0 for assignment and measurement of fringe benefits.</p>	
2.7.0	<p><i>Description of Other Direct Costs</i></p> <p>Expenses other than salaries and wages and materials and supplies, as listed in Section 2.2.0, which are charged directly to sponsored agreements may include:</p> <ol style="list-style-type: none"> <li>1) laboratory/medical supplies and services;</li> <li>2) transportation/travel/training;</li> <li>3) student /participant costs;</li> <li>4) fixed assets;</li> <li>5) contract services, including rents/leases and licenses, and subcontract cost;</li> <li>6) plant repairs and maintenance in excess of normal operations;</li> <li>7) specialized services facilities.</li> </ol> <p style="text-align: center;">End of Part</p>	

Note: →

# Benefits Summary

The employment benefits that are summarized in this document are provided as general information only. Many of these benefits described here are restricted and administered by programs far too complex to describe in this brief overview. The reader is strongly encouraged to contact the "Reference" listed for each benefit for specific information. Written policies may be found in the "University Business Policy and Procedure Manual" and the "Faculty Handbook". This benefit summary is not intended to be a statement of University Policy and should not be construed as such. Revised December 2001.

## INSURANCE BENEFITS

<u>BENEFIT</u>	<u>ELIGIBILITY</u>	<u>DESCRIPTION</u>	<u>WHO PAYS</u>	<u>CONTACT</u>
Medical Insurance	*	Group health care insurance for employee, spouse, domestic partner and qualifying dependents. Participating plans: Lovelace HMO, Presbyterian HMO, Cimarron HMO, CIGNA PPO.	UNM and employee share based on salary and FTE.	Employee Benefits 277-2341
Dental Insurance	*	Dental plan for employee, spouse, domestic partner and dependents. Managed plan (Protective Dental) or Indemnity (Delta Dental).	UNM and Employee share based on salary and FTE.	Employee Benefits 277-2341
Vision Insurance	*	Eye care for employee, spouse, domestic partner and qualifying dependents (eye exams, lenses and frames).	Employee	Employee Benefits 277-2341
Accidental Death and Dismemberment	*	Accidental death or dismemberment coverage for employee, spouse, domestic partner and qualifying dependents.	Employee	Employee Benefits 277-2341
Term Life Insurance	*	Term life insurance available for employees and their dependents.	UNM and Employee	Employee Benefits 277-2341
Term Life Supplemental	*	Term life insurance available for employee.	Employee	Employee Benefits 277-2341
Long Term Disability	*	Disability income equal to 60% of employees base monthly earnings after six continuous months of a covered disability.	UNM and Employee	Employee Benefits 277-2341
Long Term Care	*	UNM provides a \$2000 base benefit to all full-time employees after one year of benefits eligible employment. Full and part-time employees can purchase additional coverage for themselves, spouses, domestic partners, parents and grandparents.	UNM (Basic Benefit) Employee (Buy-up)	Employee Benefits 277-2341

- Regular faculty with a contract at .50 FTE or more; visiting faculty with 9-month contract at .50 FTE or more, regular staff employees at .50 FTE or more. Post Doctoral Fellow with 9-month contract at .50 FTE or more



<u>BENEFIT</u>	<u>ELIGIBILITY</u>	<u>DESCRIPTION</u>	<u>WHO PAYS</u>	<u>REFERENCE</u>
Travel Packages	Regular full and part time faculty and staff from date of hire	Discount coupons for various Theme Parks across the United States including Disney world and Six Flags.	NA	Employee Benefits 277-2341
Museum Stores	Regular full time and part time faculty and staff from date of hire	10% off all museum gift shop purchases.	Employee	Maxwell Museum 277-3766 Art Museum 277-4001
Library Services	Regular full time and part time faculty and staff from date of hire	Use of library resources including: Zimmerman Library, Law Library, and Health sciences Library.	NA	Zimmerman Library 277-5761 Law Library 277-6236

**DISCOUNTED SERVICES (CONT.)**

<u>BENEFIT</u>	<u>ELIGIBILITY</u>	<u>DESCRIPTION</u>	<u>WHO PAYS</u>	<u>REFERENCE</u>
Legal Services	Regular full and part time faculty/staff who meet income guidelines	Access to legal services dependent on caseload and case type.	Employee	Clinical Law Office 277-5265
Golf Courses	Regular full time and part time faculty and staff from date of hire	Discounts to UNM's North and Championship golf courses.	Employee	Championship Golf Course 277-4546
Credit Union	Regular full time and part time faculty and staff from date of hire	Membership to Credit Union access to all financial services.	Employee	NM Educators Federal Credit Union 889-7755
Discounted Admission Tickets	Regular full time and part time faculty and staff from date of hire	Discounted athletic and theater tickets such as Lobo Basketball and Popejoy's Ovation Series.	Employee	Athletics 925-5626 Popejoy 277-4569.
Housing Referrals	Regular full time and part time faculty/staff and students	Information on housing available in the Albuquerque area.	NA	Student Activities 277-7868
Local Gyms	Regular full time and part time faculty/staff and students	Discounts to local gyms in Albuquerque	Employee	Employee Health Promotion Program 272-3710
Child Care	Regular full time and part time faculty/staff and students	Discounts to La Petite Academy and Mountain View East School. 10% off full time day care or tuition. (Ages 2-12 only)	Employee	La Petite Academies
Cell Phone	Regular full time and part time faculty/staff and students	10% Discount to AT&T wireless phone plans. Discount to Alltel wireless phone plans.	Employee	AT&T Wireless Store. Alltel Wireless Store
Massage	Regular full time and part time	Discounts for massage.	Employee	Alpha Omega Therapeutics 880-8199

Note

\*\*\*\*\*  
\*\*\* TX REPORT \*\*\*  
\*\*\*\*\*

TRANSMISSION OK

TX/RX NO	1013	
CONNECTION TEL		997035888388
CONNECTION ID	SAF/AQRT	
ST. TIME	01/03 14:55	
USAGE T	06'25	
PGS. SENT	16	
RESULT	OK	

801 N. Randolph Street, Room 732  
Arlington, VA 22203-1977  
Phone: (703) 696-5979  
Fax: (703) 696-9733

**Air Force Office of  
Scientific Research**

# Fax

**To:** Dr. Robert Cohn **From:** Rebecca C. Applebaugh  
**Fax:** (703) 588-8388 **Date:** January 3, 2002  
**Phone:** (703) 588-7867 **Pages:** 16 including cover  
**Re:** Grant F49620-94-1-0425 (Lodestar) **CC:** [Click here and type name]  
University of New Mexico

**Urgent**   ☒ **For Review**   ☐ **Please Comment**   **Please Reply**   ☐ **Please Recycle**

**•Comments:**

Robert,

Here is the audit report from the New Mexico State Highway and Transportation Department dated Nov 28, 2001. Page 2, 2<sup>nd</sup> paragraph sums the report up. As you can see no expenditures have been disallowed. If we need to discuss this, I will be in all next week, except Monday.

801 N. Randolph Street, Room 732  
Arlington, VA 22203-1977  
Phone: (703) 696-5979  
Fax: (703) 696-9733

## Air Force Office of Scientific Research

# Fax

**To:** Dr. Robert Cohn **From:** Rebecca C. Applebaugh  
**Fax:** (703) 588-8388 **Date:** January 3, 2002  
**Phone:** (703) 588-7867 **Pages:** 16 including cover  
**Re:** Grant F49620-94-1-0425 (Lodestar) **CC:** [Click here and type name]  
University of New Mexico

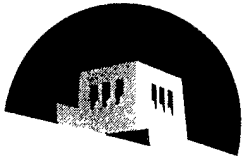
**Urgent**   ☒ **For Review**   ☐ **Please Comment**   **Please Reply**   ☐ **Please Recycle**

**•Comments:**

Robert,

Here is the audit report from the New Mexico State Highway and Transportation Department dated Nov 28, 2001. Page 2, 2<sup>nd</sup> paragraph sums the report up. As you can see no expenditures have been disallowed. If we need to discuss this, I will be in all next week, except Monday.

  
Becky



The University of New Mexico

---

Office of Research Services  
Scholes Hall 102  
Albuquerque, NM 87131-6003  
Telephone (505) 277-2256  
FAX (505) 277-5567  
<http://www.unm.edu/~ors>

December 19, 2001

Ms. Becky Applebaugh  
Air Force Office of Scientific Research/PK  
801 North Randolph Street, Room 732  
Arlington VA 22203-1977

Reference: F49620-94-1-0425

Dear Ms. Applebaugh:

Enclosed please find the audit report from the New Mexico State Highway and Transportation Department dated November 28, 2001, related to their award to UNM PIA D08809 for the Lodestar project.

If you have any questions, or require further information, please contact me.

Sincerely,

Ann Powell  
Special Assistant to the Vice  
Provost for Research

enclosure

New Mexico State Highway and Transportation Department

---

Intra-Departmental Correspondence

---

**Subject:** University of New Mexico  
Project Implementation Agreement (PIA) D08809

**Date:** 11-28-01

**To:** Emilio Martinez, Director  
Administrative Division

**Ref.:** 02-50-2

**From:** Michael Miera, Audit Manager  
Office of the Inspector General

**Thru:** Art Gottlieb, Inspector General

At the request of the Administrative Division Director and in accordance with the Project Implementation Agreement (PIA D08809), the Office of the Inspector General's Internal Audit Bureau conducted an audit of the Enchanted Skies Park project. PIA D08809 was executed between the New Mexico State Highway and Transportation Department (NMSHTD) and the University of New Mexico (UNM). The audit encompassed all expenditures incurred under PIA D08809.

The primary objectives of the audit were as follows:

- Determine whether both parties complied with agreement requirements;
- Determine whether budgets were established and monitored;
- Determine whether costs incurred were allowable, allocable and adequately supported; and,
- Determine the current cash balance and interest accrued.

The audit consisted of the review and analysis of all UNM expenditures, reports, files, budgets, proposals, and other items as related to PIA D08809. The audit also included review of UNM rules, regulations, policies and procedures. Interviews were conducted and/or information was obtained from UNM's Contract and Grant Administration, Office of General Counsel, Accounts Payable, Auxiliary Enterprises, Purchasing, Facility Planning, and Payroll Departments. Interviews were also conducted with UNM's Principal Investigator, Accountant and Lodestar's Project Manager. We would like to thank UNM's staff for their cooperation and assistance during the course of this audit.

The audit was conducted in accordance with Generally Accepted Government Auditing Standards (GAGAS), issued by the Comptroller General of the United States. These standards require that we conduct audits with adequate professional proficiency, remain independent of involved parties, and report and present findings objectively and accurately. We believe that our audit provides a reasonable basis for our opinion.

**BACKGROUND**

UNM's Lodestar project consisted of the following components: Enchanted Skies Park, New Mexico Tech and Lodestar Astronomy Center. UNM's Lodestar project was funded by federal funds through the Air Force Office of Scientific Research and by legislative appropriations by the State of New Mexico for Enchanted Skies Park in the total sum of \$12 million.

Part I of this report relates to the reimbursement of unexpended funds. Parts II and III of the report relate to audit findings and recommendations and the system improvement suggestions. The SHTD audit team issued a draft audit report to UNM on October 30, 2001. This draft report raised questions concerning the allowability of certain expenditures against these funds. Parts II and III of this report contains the SHTD's initial findings and recommendations and give the University's response to these findings and recommendations. On the basis of the responses provided by the University, the SHTD is not disallowing any expenditures made against these funds by the UNM, and the UNM agrees to return the undisputed balance to SHTD immediately.

## **Part I – UNEXPENDED FUNDS**

In a letter dated June 14, 2001, to the Air Force Office of Scientific Research, it stated: "UNM is exercising its termination rights under OMB Circular A-110, 32 CFR Section 32.61, and terminating the grant effective June 30, 2001." The letter was referring to the Lodestar project of which the Enchanted Skies Park was a component.

A letter dated June 29, 2001 to Mark Valdes, Senior Fiscal Analyst, Legislative Finance Committee, stated:

1. that UNM had elected not to build the Enchanted Skies Park component of the Lodestar project and cancelled the grant effective June 30, 2001;
2. that as of May 31, 2001 a total of \$3,191,125 had been expended out of the \$12 million road fund under PIA D08809; and,
3. that as of May 31, 2001 a total amount of \$1,246,164 in interest had been accrued.

UNM's Financial Records System account statement indicates that on September 30, 2001, 90 days from the termination date, the project had expended a total of \$3,366,175.92.

Total Amount of Agreement	\$12,000,000.00
Total Audited Expenditures	<u>3,366,175.92</u>
Balance	\$ 8,633,824.08
Post Audit Expenditures	<u>96,506.08</u>
Total Due the Department	\$ 8,537,318.00

In accordance with PIA D08809, Section V-Federal Matching Funds Requirement, "If for any reason, the Enchanted Skies portion of the Lodestar Grant is wholly or partially terminated, UNM shall refund to SHTD any unexpended portions of the state funds."

## **Part 1 Summary**

It is clear that the documentation provided to NMSHTD by UNM indicates that UNM has the undisputed and unexpended amount of \$8,537,318.00. PIA D08809 provides under Section V that UNM shall refund to NMSHTD any unexpended portions of the state funds. UNM cancelled the Enchanted Skies Park component of the Lodestar project effective June 30, 2001. Therefore, UNM is obligated to immediately refund to NMSHTD the unexpended amount of \$8,537,318.00.

## Part II - FINDINGS AND RECOMMENDATIONS

### Finding No. 1 – Noncompliance with RFP Process

#### Condition

During our review of consultant documentation, it was noted that the project manager was contracted without a Request for Proposal and was paid a monthly retainer fee with no requirement or justification of fees. Further research revealed a Proposal for Services was absent for over a two-year period, in which work was being performed.

#### Criteria

- Section 13-1-112, NMSA 1978 states that "Competitive sealed proposals...shall be solicited through a request for proposals which shall be issued and shall include the specifications for the services...all contractual terms and conditions applicable to the procurement, the location where proposals are to be received and the date, time and place where proposals are to be received and reviewed;" and.
- Section 13-1-125, NMSA 1978 states that "A central purchasing office may procure professional services having a value not exceeding twenty thousand dollars (\$20,000), excluding applicable state and local gross receipts taxes."

#### Effects

- Noncompliance with Procurement Code and applicable regulations;
- Potential for not using funds in the most cost-effective manner; and,
- Possible overpayment for services rendered.

#### Cause

UNM never issued a request for proposal because the project manager was initially hired part time.

#### Recommendation

In future agreements with NMSHTD, UNM comply with the Procurement Code and applicable regulations.

#### Response

UNM fulfilled the requirements for sole source procurements, Section 13-1-126 of the State Procurement Code, in procuring the services of the project manager. UNM was in compliance with the Procurement Code.

The provisions of the Procurement Code cited to in the report are not applicable to the hiring of the project manager. As UNM arranged for the project manager's services through sole source procurement procedures, there was no need to issue a request for proposal. Under §13-1-126 of the Procurement Code, contracts may be awarded without using the competitive bid process if there is a determination "after going through a good-faith review of available sources...that there is only one source for the

required service." UNM used this process to determine that the project manager was in a unique position to support the project.

## **Finding No. 2 – Funds Used to Purchase UNM Sports Tickets**

### **Condition**

Review of expenditures under PIA D08809 revealed that UNM sports tickets were purchased for UNM employees with funds provided under this Agreement.

### **Criteria**

In accordance with OMB Circular A-21, Cost Principles for Educational Institutions, No. 15, "Costs of entertainment, including amusement, diversion, and social activities and any costs directly associated with such costs (such as tickets to shows or sports events, meals, lodging, rentals, transportation, and gratuities) are unallowable."

### **Effects**

- Noncompliance with the appropriation, PIA D08809 and OMB Circular A-21;
- Improper use of funds; and,
- Possible loss of future funding.

### **Cause**

UNM allowed employees to charge sports tickets as Employee Payroll Benefits and Discounts against NMSHTD funds.

### **Recommendation**

In future agreements, UNM refrain from charging sports tickets to NMSHTD agreements.

### **Response**

The discount on athletic tickets is not an "entertainment" expense, but an employee fringe benefit; for at least 20 years, these discounts on athletic tickets have been accepted as a fringe benefit by federal and state audits.

The auditor incorrectly identified the expense as "entertainment," which we concur would not be allowable under OMB Circular A-21. Discounts on UNM athletic and other event season tickets are a recognized part of the compensation and benefit package of UNM to which faculty and staff are entitled. The benefit has been specifically identified and approved by the federal government as a direct cost to federal projects. See, Cost Accounting Standards Board Disclosure Statement DS-2 in which there is a specific disclosure that "employee discounts on athletic and fine arts events" are included as direct fringe benefits costs charged to federal grants. Further, the compensation is reported to the IRS via employee form W-2 and taxed accordingly.

## **Finding No. 3 – Misclassified Labor Expenditures**

### **Condition**



During our review, it was noted that UNM charged unrelated labor expenditures to NMSHTD funds rather than the federal grant. For example:

- UNM has charged 100% of the monthly project manager's labor expenditures to the Agreement. The invoices represented a monthly retainer for Lodestar Project Management, which included numerous projects other than the Enchanted Skies Park; and,
- UNM has charged labor expenditures of UNM employees and students contracted with the Lodestar Astronomy Center and labor expenditures for education, public education and outreach programs, which are unrelated to the Enchanted Skies Park.

### Criteria

In accordance with PIA D08809, Section VI – Use of Funds, "UNM may use the State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing."

### Effects

- Noncompliance with appropriations and PIA D08809;
- Unable to account for NMSHTD funds; and,
- Possible loss of future funding.

### Causes

- UNM did not pro-rate the project manager's labor expenditures among the numerous projects thereby misclassifying the unrelated expenditures; and,
- UNM misclassified labor charges for the Lodestar Astronomy Center and education, public education and outreach programs, which were unrelated to the Enchanted Skies Park.

### Recommendations

In future agreements with NMSHTD, UNM closely monitor agreements to ensure that expenditures are adequately identified, accounted for and allocable to agreements.

### Response

The project manager has certified that his charges to the Enchanted Skies Park are reasonable and proportional to the time and effort he expended on that part of the LodeStar project.

UNM recognizes that it initially could have charged these expenditures to the federal funds. However, PIA D08809 provides UNM full discretion to decide which expenditures should be charged to federal funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding.

## **Finding No. 4 – Funds Used to Purchase Airline Tickets**

### **Condition**

UNM expended NMSHTD funds to purchase airline tickets and associated expenditures for the project manager to fly to Alaska for purposes unrelated to the Enchanted Skies Park project.

### **Criteria**

In accordance with PIA D08809, Section VI – Use of Funds, “UNM may use the State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing.”

### **Effects**

- Noncompliance with appropriations and PIA D08809;
- Improper use of NMSHTD funds; and,
- Possible loss of future funding.

### **Cause**

It was stipulated in the project manager’s Proposal of Services that UNM would allow expenditures for monthly trips to Alaska. In addition, the funds were misclassified in which the airline tickets were paid from NMSHTD funds rather than federal grant funds.

### **Recommendation**

In future agreements with NMSHTD, UNM closely monitor agreements to ensure that expenditures are adequately identified, accounted for and allocable to agreements.

### **Response**

As the auditor has acknowledged, it was stipulated in the project manager’s proposal that UNM pay for travel costs to and from Alaska. Accordingly, these expenses were an allowable and reasonable part of his contracted compensation and a legitimate expense to the project.

When UNM retained the project manager, he was based in Alaska and working there on a long-term project. The project manager was willing to come to New Mexico to work on the LodeStar project for significant periods of time, until the Alaska project was completed. He was willing to do this provided that UNM paid the round trip travel costs to periodically bring him to New Mexico and return him to Alaska. Though this expense could have been imbedded into his base fee, it was instead listed as a separate expense. It is not unusual for UNM to reimburse consultants, candidates, and other individuals for their travel expenses.

Further, the auditor states that the project manager worked on numerous LodeStar projects in addition to Enchanted Skies Park. The LodeStar project had only three main components, not numerous ones. The project manager worked primarily on Enchanted Skies Park, but also worked for a small percentage of his time at the LodeStar Astronomy Center.

UNM recognizes that it initially could have charged these expenditures to the federal funds. However, PIA D08809 provides UNM full discretion to decide which expenditures should be charged to federal

funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding.

#### **Finding No. 5 – Project Budget Not Properly Planned or Maintained**

##### **Condition**

During our review of the established project budget for NMSHTD funds, it was noted that UNM did not properly plan and maintain the project budget. Line items were not properly added, deleted, increased or decreased to accurately reflect funds, expenditures and balances. It was also noted that UNM made some of the budget line item corrections after the project had been terminated. Examples of budget inaccuracies are:

- Line item budgets for postage, computer supplies/maintenance, student salaries, report costs, tuition compensation and temporary employment services were not included in the original budget and were not added or increased when expenditures had been accrued;
- UNM deleted an established \$10,000 budget line item for Advertising and Publicity in which \$13,466.31 had already been expensed; and,
- Project contractual services budget remained at \$750,000 although \$2,426,126.32 had been expended.

##### **Criteria**

In accordance with GASB Cod. Sec. 2400.102, a combined statement of revenues, expenditures and changes in fund balances, budget and actual, is required for the general and special revenue fund types and for other governmental category funds for which annual budgets have been adopted. If the budget has been amended during the year, the final amended budget should be presented.

##### **Effects**

- Inefficient budget structure;
- Deficit line item balances;
- Improper budget accounting;
- Inability to monitor expenditures; and,
- Overruns not evident.

##### **Cause**

UNM applied the budget requirements stipulated for federal grant monies to NMSHTD funds.

##### **Recommendation**

For future agreements, UNM properly develop and maintain budgets for all NMSHTD funds received and document the transfer process.

##### **Response**

The auditor cites a section of the code that is not applicable to UNM and, therefore, not required of UNM; nonetheless, UNM's budget for this project easily meets these criteria.

UNM budgets externally funded grants according to grant specifications as well as internal management needs. The auditor cites to GASB Cod. Sec. 2400.102 as criteria, which applies to entities under "governmental funds" and is not applicable to UNM.

Even if it were applicable, however, UNM met the criteria which state that, "only the total budget and total actual data for all special revenue funds (and for every other budgeted governmental fund type of the primary government) are required."

#### **Finding No. 6 – Funds Intended to Furnish/Equip Park Used for Contractual Services**

##### **Condition**

During our review of purchasing documents, it was noted that UNM used funds budgeted to equip and furnish Enchanted Skies Park to pay for cost overruns for contractual services. It was also noted that UNM adjusted budgets accordingly after the project was terminated.

##### **Criteria**

Prudent business practices suggest that proper accountability of funds increases the ability to monitor funds in a more efficient manner. Also, using a consistent methodology for encumbering, monitoring and reporting data will ensure that funds are available.

##### **Effects**

- Funds not expended as intended pursuant to appropriation and PIA D08809;
- Inability to equip and furnish Enchanted Skies Park;
- Deficit line item balances;
- Funds not properly accounted for;
- Inaccurate records; and,
- Overruns not evident.

##### **Cause**

UNM believed they would obtain additional funding sources so Enchanted Skies Park could be equipped and furnished.

##### **Recommendation**

We recommend UNM expend monies according to established budgets, monitor the budgets and maintain budgets of NMSHTD funds on at least a fiscal year basis.

##### **Response**

These expenditures for contractual services were allowable and reasonable ones for Enchanted Skies Park. Though UNM may have exceeded the allowances for certain subcategories in its internal budgets, there was no over expenditure of available project funds. UNM was aware that the amount budgeted for contractual services had exceeded the anticipated amount due to increases in the environmental compliance costs for the project. As the auditor indicated, at the termination of the project UNM adjusted its internal budgets to reflect actual spending for these contractual services.

The contractual services referred to in the finding were an integral part of the planning, infrastructure, construction, and equipping of Enchanted Skies Park. According to the language contained in PIA DO8809, "UNM may use the State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing."

#### **Finding No. 7 – Misclassified Advertising and Publicity Expenditures**

##### **Condition**

Review and research of the budget line item for Advertising and Publicity revealed that UNM committed NMSHTD funds as matching cooperative advertising funds for educational outreach and public information under its Lodestar Project through the New Mexico Department of Tourism.

##### **Criteria**

In accordance with PIA DO8809, Section VI – Use of Funds, "UNM may use State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing."

##### **Effects**

- Noncompliance with appropriations and PIA DO8809;
- Improper use of funds; and,
- Possible loss of future funding.

##### **Cause**

UNM misclassified Lodestar advertising costs by charging NMSHTD funds rather than the federal grant.

##### **Recommendation**

In future agreements with NMSHTD, UNM closely monitor agreements to ensure that expenditures are adequately identified, accounted for and allocable to agreements.

##### **Response**

These expenditures were allowable and reasonable ones for Enchanted Skies Park and clearly can be funded with federal funds for the project.

UNM recognizes that it initially could have charged these expenditures to the federal funds. However, PIA DO8809 provides UNM full discretion to decide which expenditures should be charged to federal funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding

## **Finding No. 8 – Insufficient Accounting of Blanket Purchase Orders**

### **Condition**

During our review, it was noted that UNM did not immediately charge all project expenditures to appropriate accounts. UNM held expenditures accrued under open blanket purchase orders for over two years before charging fund accounts. Further review revealed UNM's Financial Reporting System (FRS) does not show any encumbrances issued for consultant blanket purchase orders. A blanket purchase order was issued to a consultant for a period of time longer than the Proposal of Services.

### **Criteria**

- Section 13-1-169, NMSA 1978 of the New Mexico Procurement Code states that "The central purchasing office may consolidate procurements and may contract for items of tangible personal property or services at a firm price at which the items or services needed during the year or portion of a year shall be purchased;" and.
- UNM Business Policy 4320, Section 4.2 Blanket and Open Purchase Orders, states that "Blanket Purchase Orders are encumbered by the University accounting system."

### **Effect**

UNM is in noncompliance with state statutes and its own business policy.

### **Cause**

The Lodestar project accountant mistakenly referred to some of the purchase orders for the Lodestar consultants as blanket purchase orders, rather than open purchase orders.

### **Recommendation**

In future agreements with NMSHTD, UNM comply with the Procurement Code and applicable regulations regarding blanket purchase orders.

### **Response**

There was no violation of the referenced provisions of the Procurement Code because UNM is not subject to those provisions, nor is UNM out of compliance with its internal policies regarding purchase orders.

UNM is not required to follow encumbrance accounting and does so only for internal management reporting. The auditor identified the subject purchase order as a "blanket" order instead of an "open" order. Blanket orders are for the purchase of tangible goods. This procurement was for a service. "Blankets" are internally encumbered. "Open" orders are not. Under provisions of PIA D08809, UNM has full discretion in determining the source of funds to charge for Enchanted Skies Park expenditures, i.e. state or federal.

## **Finding No. 9 – Insufficient Source Documentation**

### **Condition**

Upon review of expenditures under PIA D08809, insufficient source documentation was not supported

or substantiated for the Enchanted Skies Park project. For example:

- Source documents did not contain justifications substantiating purchases made with NMSHTD funds; and,
- Source documents identified only "Lodestar" or "Lodestar Project" as the source in which the expenditures were incurred.

#### Criteria

- PIA D08809, Section VII – Financial Accountability, "UNM will maintain the State Funds in a separate UNM restricted account, and provide separate detailed accounting to the state, upon request, of all expenditures and transfers made from the State Funds;" and,
- PIA D08809, Section VIII – Audit, " UNM represents that its system of internal accounting controls is prudent and accurate and that it maintains supporting documentation for all accounting transactions. Its records are consistent with generally accepted accounting principles, and in accordance with federal agency requirements."

#### Effects

- Noncompliance with PIA D08809;
- Lack of consistent accounting and internal control methodology;
- Possible overpayment of expenditures; and,
- Inadequate audit trail.

#### Cause

UNM did not establish a source document system that provided the required detail needed to separate Enchanted Skies Park expenditures from Lodestar project costs.

#### Recommendation

For future agreements with NMSHTD, UNM ensure that source documents are required on all expenditures and that full explanations are required on all purchase orders, invoices and expenditures.

#### Response

UNM made all requested source documentation available to the auditor. UNM is not aware of any deficiency in expenditure documentation or in its system of internal accounting controls.

#### **Finding No. 10 – Misclassified Marketing Expenditures**

##### Condition

During our review of source documents, it was noted UNM expended NMSHTD funds on Lodestar project marketing services and related expenditures, which were unallowable under PIA D08809.

##### Criteria

In accordance with PIA D08809, Section VI – Use of Funds, "UNM may use the State Funds for

expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing.”

#### Effects

- Noncompliance with appropriations and PIA D08809;
- Funds improperly spent; and,
- Possible loss of future funding.

#### Cause

UNM misclassified marketing expenditures by charging them to PIA D08809 rather than the federal grant.

#### Recommendation

For future agreements with NMSHTD, UNM ensure that source documents are required on all expenditures and that full explanations are required on all purchase orders, invoices and expenditures.

#### Response

These were all allowable and reasonable expenses for Enchanted Skies Park.

UNM recognizes that it could have initially charged these expenditures to the federal funds. However, PIA D08809 provides UNM full discretion to decide which expenditures should be charged to federal funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding.

### **Finding No. 11 – Misclassified General Expenditures**

#### Condition

UNM expended NMSHTD funds for general expenditures related to the Lodestar Astronomy Center and education, public education and outreach programs, which are unrelated to the Enchanted Skies Park.

#### Criteria

In accordance with PIA D08809, Section VI – Use of Funds, “UNM may use the State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing.”

#### Effects

- Noncompliance with appropriations and PIA D08809;
- Improper use of funds; and,
- Possible loss of future funding.



### Cause

UNM misclassified general expenditures by charging NMSHTD funds rather than the federal grant.

### Recommendation

For future agreements with NMSHTD, UNM ensure that source documents are required on all expenditures and that full explanations are required on all purchase orders, invoices and expenditures.

### Response

These were all allowable and reasonable expenses for Enchanted Skies Park.

UNM recognizes that it could have initially charged these expenditures to the federal funds. However, PIA DO8809 provides UNM full discretion to decide which expenditures should be charged to federal funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding.

## **Part III – SYSTEM IMPROVEMENT SUGGESTIONS**

### **Suggestion No. 1 – Interest Earned on Funds**

#### Condition

On June 30, 2001 UNM terminated its federal Lodestar grant of which the Enchanted Skies Park was a component; however, NMSHTD has not received payment from UNM for the interest earned on the \$12 million state road funds received under PIA D08809. UNM's report to the Legislative Finance Committee stated that as of May 31, 2001 it had accrued \$1,246,164 in interest since it received the funds.

#### Suggestion

UNM and NMSHTD negotiate on an equitable settlement on the interest earned.

#### Response

The University of New Mexico and the State Highway and Transportation Department will negotiate the status of payment on interest earned.

### **Suggestion No. 2 – Improve Records Management**

#### Condition

Upon our review of the UNM Purchasing Department's documents and requests for pertinent data, it

was noted that UNM's records management was insufficient. For example:

- Consultant proposals, blanket purchase orders, modifications and request for proposals with responses were not properly filed or organized; and,
- Pertinent accounting data and documents were either lost or misplaced.

#### Suggestion

For future agreements with NMSHTD, UNM's Contract and Grant Administration ensure all future project records are properly documented and retained and that UNM's Purchasing Department file all consultant documentation accordingly and in an organized manner.

#### Response

UNM is always interested in improving its systems for maintaining documentation and other internal control mechanisms and will give this suggestion careful consideration.

MP:SE

xc: Pete Rahn., Secretary, NMSHTD  
Julie Weeks, Vice President for Business & Finance, UNM  
Audit File

801 N. Randolph Street, Room 732  
Arlington, VA 22203-1977  
Phone: (703) 696-5979  
Fax: (703) 696-9733

## Air Force Office of Scientific Research

# Fax

**To:** Dr. Robert Cohn **From:** Rebecca C. Applebaugh  
**Fax:** (703) 588-8388 **Date:** January 3, 2002  
**Phone:** (703) 588-7867 **Pages:** 16 including cover  
**Re:** Grant F49620-94-1-0425 (Lodestar) **CC:** [Click here and type name]  
University of New Mexico

**Urgent**   ☒ **For Review**   ☐ **Please Comment**   **Please Reply**   ☐ **Please Recycle**

**•Comments:**

**Robert,**

Here is the audit report from the New Mexico State Highway and Transportation Department dated Nov 28, 2001. Page 2, 2<sup>nd</sup> paragraph sums the report up. As you can see no expenditures have been disallowed. If we need to discuss this, I will be in all next week, except Monday.

*Becky*  
**Becky**



**The University of New Mexico**

Office of Research Services  
Scholes Hall 102  
Albuquerque, NM 87131-6003  
Telephone (505) 277-2256  
FAX (505) 277-5567  
<http://www.unm.edu/~ors>

December 19, 2001

Ms. Becky Applebaugh  
Air Force Office of Scientific Research/PK  
801 North Randolph Street, Room 732  
Arlington VA 22203-1977

Reference: F49620-94-1-0425

Dear Ms. Applebaugh:

Enclosed please find the audit report from the New Mexico State Highway and Transportation Department dated November 28, 2001, related to their award to UNM PIA D08809 for the Lodestar project.

If you have any questions, or require further information, please contact me.

Sincerely,

Ann Powell  
Special Assistant to the Vice  
Provost for Research

enclosure

Form No. A-110  
Rev. 1-91

## New Mexico State Highway and Transportation Department

## Intra-Departmental Correspondence

**Subject:** University of New Mexico  
Project Implementation Agreement (PIA) D08809

**Date:** 11-28-01

**To:** Emilio Martinez, Director  
Administrative Division

**Ref.:** 02-50-2

**From:** Michael Miera, Audit Manager  
Office of the Inspector General

**Thru:** Art Gottlieb, Inspector General

At the request of the Administrative Division Director and in accordance with the Project Implementation Agreement (PIA D08809), the Office of the Inspector General's Internal Audit Bureau conducted an audit of the Enchanted Skies Park project. PIA D08809 was executed between the New Mexico State Highway and Transportation Department (NMSHTD) and the University of New Mexico (UNM). The audit encompassed all expenditures incurred under PIA D08809.

The primary objectives of the audit were as follows:

- Determine whether both parties complied with agreement requirements;
- Determine whether budgets were established and monitored;
- Determine whether costs incurred were allowable, allocable and adequately supported; and,
- Determine the current cash balance and interest accrued.

The audit consisted of the review and analysis of all UNM expenditures, reports, files, budgets, proposals, and other items as related to PIA D08809. The audit also included review of UNM rules, regulations, policies and procedures. Interviews were conducted and/or information was obtained from UNM's Contract and Grant Administration, Office of General Counsel, Accounts Payable, Auxiliary Enterprises, Purchasing, Facility Planning, and Payroll Departments. Interviews were also conducted with UNM's Principal Investigator, Accountant and Lodestar's Project Manager. We would like to thank UNM's staff for their cooperation and assistance during the course of this audit.

The audit was conducted in accordance with Generally Accepted Government Auditing Standards (GAGAS), issued by the Comptroller General of the United States. These standards require that we conduct audits with adequate professional proficiency, remain independent of involved parties, and report and present findings objectively and accurately. We believe that our audit provides a reasonable basis for our opinion.

**BACKGROUND**

UNM's Lodestar project consisted of the following components: Enchanted Skies Park, New Mexico Tech and Lodestar Astronomy Center. UNM's Lodestar project was funded by federal funds through the Air Force Office of Scientific Research and by legislative appropriations by the State of New Mexico for Enchanted Skies Park in the total sum of \$12 million.

Part I of this report relates to the reimbursement of unexpended funds. Parts II and III of the report relate to audit findings and recommendations and the system improvement suggestions. The SHTD audit team issued a draft audit report to UNM on October 30, 2001. This draft report raised questions concerning the allowability of certain expenditures against these funds. Parts II and III of this report contains the SHTD's initial findings and recommendations and give the University's response to these findings and recommendations. On the basis of the responses provided by the University, the SHTD is not disallowing any expenditures made against these funds by the UNM, and the UNM agrees to return the undisputed balance to SHTD immediately.

### Part I - UNEXPENDED FUNDS

In a letter dated June 14, 2001, to the Air Force Office of Scientific Research, it stated: "UNM is exercising its termination rights under OMB Circular A-110, 32 CFR Section 32.61, and terminating the grant effective June 30, 2001." The letter was referring to the Lodestar project of which the Enchanted Skies Park was a component.

A letter dated June 29, 2001 to Mark Valdes, Senior Fiscal Analyst, Legislative Finance Committee, stated:

1. that UNM had elected not to build the Enchanted Skies Park component of the Lodestar project and cancelled the grant effective June 30, 2001;
2. that as of May 31, 2001 a total of \$3,191,125 had been expended out of the \$12 million road fund under PIA D08809; and,
3. that as of May 31, 2001 a total amount of \$1,246,164 in interest had been accrued.

UNM's Financial Records System account statement indicates that on September 30, 2001, 90 days from the termination date, the project had expended a total of \$3,366,175.92.

Total Amount of Agreement	\$12,000,000.00
Total Audited Expenditures	<u>3,366,175.92</u>
Balance	\$ 8,633,824.08
Post Audit Expenditures	<u>96,506.08</u>
Total Due the Department	\$ 8,537,318.00

In accordance with PIA D08809, Section V-Federal Matching Funds Requirement, "If for any reason, the Enchanted Skies portion of the Lodestar Grant is wholly or partially terminated, UNM shall refund to SHTD any unexpended portions of the state funds."

### Part 1 Summary

It is clear that the documentation provided to NMSHTD by UNM indicates that UNM has the undisputed and unexpended amount of \$8,537,318.00. PIA D08809 provides under Section V that UNM shall refund to NMSHTD any unexpended portions of the state funds. UNM cancelled the Enchanted Skies Park component of the Lodestar project effective June 30, 2001. Therefore, UNM is obligated to immediately refund to NMSHTD the unexpended amount of \$8,537,318.00.

## Part II - FINDINGS AND RECOMMENDATIONS

### Finding No. 1 – Noncompliance with RFP Process

#### Condition

During our review of consultant documentation, it was noted that the project manager was contracted without a Request for Proposal and was paid a monthly retainer fee with no requirement or justification of fees. Further research revealed a Proposal for Services was absent for over a two-year period, in which work was being performed.

#### Criteria

- Section 13-1-112, NMSA 1978 states that "Competitive sealed proposals...shall be solicited through a request for proposals which shall be issued and shall include the specifications for the services...all contractual terms and conditions applicable to the procurement, the location where proposals are to be received and the date, time and place where proposals are to be received and reviewed;" and,
- Section 13-1-125, NMSA 1978 states that "A central purchasing office may procure professional services having a value not exceeding twenty thousand dollars (\$20,000), excluding applicable state and local gross receipts taxes."

#### Effects

- Noncompliance with Procurement Code and applicable regulations;
- Potential for not using funds in the most cost-effective manner; and,
- Possible overpayment for services rendered.

#### Cause

UNM never issued a request for proposal because the project manager was initially hired part time.

#### Recommendation

In future agreements with NMSHTD, UNM comply with the Procurement Code and applicable regulations.

#### Response

UNM fulfilled the requirements for sole source procurements. Section 13-1-126 of the State Procurement Code, in procuring the services of the project manager. UNM was in compliance with the Procurement Code.

The provisions of the Procurement Code cited to in the report are not applicable to the hiring of the project manager. As UNM arranged for the project manager's services through sole source procurement procedures, there was no need to issue a request for proposal. Under §13-1-126 of the Procurement Code, contracts may be awarded without using the competitive bid process if there is a determination "after going through a good-faith review of available sources...that there is only one source for the

required service." UNM used this process to determine that the project manager was in a unique position to support the project.

## **Finding No. 2 – Funds Used to Purchase UNM Sports Tickets**

### **Condition**

Review of expenditures under PIA D08809 revealed that UNM sports tickets were purchased for UNM employees with funds provided under this Agreement.

### **Criteria**

In accordance with OMB Circular A-21, Cost Principles for Educational Institutions, No. 15, "Costs of entertainment, including amusement, diversion, and social activities and any costs directly associated with such costs (such as tickets to shows or sports events, meals, lodging, rentals, transportation, and gratuities) are unallowable."

### **Effects**

- Noncompliance with the appropriation, PIA D08809 and OMB Circular A-21;
- Improper use of funds; and,
- Possible loss of future funding.

### **Cause**

UNM allowed employees to charge sports tickets as Employee Payroll Benefits and Discounts against NMSHTD funds.

### **Recommendation**

In future agreements, UNM refrain from charging sports tickets to NMSHTD agreements.

### **Response**

The discount on athletic tickets is not an "entertainment" expense, but an employee fringe benefit; for at least 20 years, these discounts on athletic tickets have been accepted as a fringe benefit by federal and state audits.

The auditor incorrectly identified the expense as "entertainment," which we concur would not be allowable under OMB Circular A-21. Discounts on UNM athletic and other event season tickets are a recognized part of the compensation and benefit package of UNM to which faculty and staff are entitled. The benefit has been specifically identified and approved by the federal government as a direct cost to federal projects. See, Cost Accounting Standards Board Disclosure Statement DS-2 in which there is a specific disclosure that "employee discounts on athletic and fine arts events" are included as direct fringe benefits costs charged to federal grants. Further, the compensation is reported to the IRS via employee form W-2 and taxed accordingly.

## **Finding No. 3 – Misclassified Labor Expenditures**

### **Condition**



During our review, it was noted that UNM charged unrelated labor expenditures to NMSHTD funds rather than the federal grant. For example:

- UNM has charged 100% of the monthly project manager's labor expenditures to the Agreement. The invoices represented a monthly retainer for Lodestar Project Management, which included numerous projects other than the Enchanted Skies Park; and,
- UNM has charged labor expenditures of UNM employees and students contracted with the Lodestar Astronomy Center and labor expenditures for education, public education and outreach programs, which are unrelated to the Enchanted Skies Park.

### Criteria

In accordance with PIA D08809, Section VI – Use of Funds, “UNM may use the State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing.”

### Effects

- Noncompliance with appropriations and PIA D08809;
- Unable to account for NMSHTD funds; and,
- Possible loss of future funding.

### Causes

- UNM did not pro-rate the project manager's labor expenditures among the numerous projects thereby misclassifying the unrelated expenditures; and,
- UNM misclassified labor charges for the Lodestar Astronomy Center and education, public education and outreach programs, which were unrelated to the Enchanted Skies Park.

### Recommendations

In future agreements with NMSHTD, UNM closely monitor agreements to ensure that expenditures are adequately identified, accounted for and allocable to agreements.

### Response

The project manager has certified that his charges to the Enchanted Skies Park are reasonable and proportional to the time and effort he expended on that part of the LodeStar project.

UNM recognizes that it initially could have charged these expenditures to the federal funds. However, PIA D08809 provides UNM full discretion to decide which expenditures should be charged to federal funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding.

**Finding No. 4 – Funds Used to Purchase Airline Tickets****Condition**

UNM expended NMSHTD funds to purchase airline tickets and associated expenditures for the project manager to fly to Alaska for purposes unrelated to the Enchanted Skies Park project.

**Criteria**

In accordance with PIA D08809, Section VI – Use of Funds, “UNM may use the State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing.”

**Effects**

- Noncompliance with appropriations and PIA D08809;
- Improper use of NMSHTD funds; and,
- Possible loss of future funding.

**Cause**

It was stipulated in the project manager's Proposal of Services that UNM would allow expenditures for monthly trips to Alaska. In addition, the funds were misclassified in which the airline tickets were paid from NMSHTD funds rather than federal grant funds.

**Recommendation**

In future agreements with NMSHTD, UNM closely monitor agreements to ensure that expenditures are adequately identified, accounted for and allocable to agreements.

**Response**

As the auditor has acknowledged, it was stipulated in the project manager's proposal that UNM pay for travel costs to and from Alaska. Accordingly, these expenses were an allowable and reasonable part of his contracted compensation and a legitimate expense to the project.

When UNM retained the project manager, he was based in Alaska and working there on a long-term project. The project manager was willing to come to New Mexico to work on the LodeStar project for significant periods of time, until the Alaska project was completed. He was willing to do this provided that UNM paid the round trip travel costs to periodically bring him to New Mexico and return him to Alaska. Though this expense could have been imbedded into his base fee, it was instead listed as a separate expense. It is not unusual for UNM to reimburse consultants, candidates, and other individuals for their travel expenses.

Further, the auditor states that the project manager worked on numerous LodeStar projects in addition to Enchanted Skies Park. The LodeStar project had only three main components, not numerous ones. The project manager worked primarily on Enchanted Skies Park, but also worked for a small percentage of his time at the LodeStar Astronomy Center.

UNM recognizes that it initially could have charged these expenditures to the federal funds. However, PIA D08809 provides UNM full discretion to decide which expenditures should be charged to federal

funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding.

#### **Finding No. 5 – Project Budget Not Properly Planned or Maintained**

##### **Condition**

During our review of the established project budget for NMSHTD funds, it was noted that UNM did not properly plan and maintain the project budget. Line items were not properly added, deleted, increased or decreased to accurately reflect funds, expenditures and balances. It was also noted that UNM made some of the budget line item corrections after the project had been terminated. Examples of budget inaccuracies are:

- Line item budgets for postage, computer supplies/maintenance, student salaries, report costs, tuition compensation and temporary employment services were not included in the original budget and were not added or increased when expenditures had been accrued;
- UNM deleted an established \$10,000 budget line item for Advertising and Publicity in which \$13,466.31 had already been expensed; and,
- Project contractual services budget remained at \$750,000 although \$2,426,126.32 had been expended.

##### **Criteria**

In accordance with GASB Cod. Sec. 2400.102, a combined statement of revenues, expenditures and changes in fund balances, budget and actual, is required for the general and special revenue fund types and for other governmental category funds for which annual budgets have been adopted. If the budget has been amended during the year, the final amended budget should be presented.

##### **Effects**

- Inefficient budget structure;
- Deficit line item balances;
- Improper budget accounting;
- Inability to monitor expenditures; and,
- Overruns not evident.

##### **Cause**

UNM applied the budget requirements stipulated for federal grant monies to NMSHTD funds.

##### **Recommendation**

For future agreements, UNM properly develop and maintain budgets for all NMSHTD funds received and document the transfer process.

##### **Response**

The auditor cites a section of the code that is not applicable to UNM and, therefore, not required of UNM; nonetheless, UNM's budget for this project easily meets these criteria.

UNM budgets externally funded grants according to grant specifications as well as internal management needs. The auditor cites to GASB Cod. Sec. 2400.102 as criteria, which applies to entities under "governmental funds" and is not applicable to UNM.

Even if it were applicable, however, UNM met the criteria which state that, "only the total budget and total actual data for all special revenue funds (and for every other budgeted governmental fund type of the primary government) are required."

#### **Finding No. 6 – Funds Intended to Furnish/Equip Park Used for Contractual Services**

##### **Condition**

During our review of purchasing documents, it was noted that UNM used funds budgeted to equip and furnish Enchanted Skies Park to pay for cost overruns for contractual services. It was also noted that UNM adjusted budgets accordingly after the project was terminated.

##### **Criteria**

Prudent business practices suggest that proper accountability of funds increases the ability to monitor funds in a more efficient manner. Also, using a consistent methodology for encumbering, monitoring and reporting data will ensure that funds are available.

##### **Effects**

- Funds not expended as intended pursuant to appropriation and PIA D08809;
- Inability to equip and furnish Enchanted Skies Park;
- Deficit line item balances;
- Funds not properly accounted for;
- Inaccurate records; and,
- Overruns not evident.

##### **Cause**

UNM believed they would obtain additional funding sources so Enchanted Skies Park could be equipped and furnished.

##### **Recommendation**

We recommend UNM expend monies according to established budgets, monitor the budgets and maintain budgets of NMSHTD funds on at least a fiscal year basis.

##### **Response**

These expenditures for contractual services were allowable and reasonable ones for Enchanted Skies Park. Though UNM may have exceeded the allowances for certain subcategories in its internal budgets, there was no over expenditure of available project funds. UNM was aware that the amount budgeted for contractual services had exceeded the anticipated amount due to increases in the environmental compliance costs for the project. As the auditor indicated, at the termination of the project UNM adjusted its internal budgets to reflect actual spending for these contractual services.

The contractual services referred to in the finding were an integral part of the planning, infrastructure, construction, and equipping of Enchanted Skies Park. According to the language contained in PIA DO8809, "UNM may use the State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing."

#### **Finding No. 7 – Misclassified Advertising and Publicity Expenditures**

##### **Condition**

Review and research of the budget line item for Advertising and Publicity revealed that UNM committed NMSHTD funds as matching cooperative advertising funds for educational outreach and public information under its Lodestar Project through the New Mexico Department of Tourism.

##### **Criteria**

In accordance with PIA DO8809, Section VI – Use of Funds, "UNM may use State Funds for expenditures reasonably necessary for infrastructure, construction, and equipping Enchanted Skies Park, including, but not limited to, expenditures for planning, administration, architecture and engineering services, environmental analysis, and right of way activities, including, but not limited to, land acquisition and leasing."

##### **Effects**

- Noncompliance with appropriations and PIA DO8809;
- Improper use of funds; and,
- Possible loss of future funding.

##### **Cause**

UNM misclassified Lodestar advertising costs by charging NMSHTD funds rather than the federal grant.

##### **Recommendation**

In future agreements with NMSHTD, UNM closely monitor agreements to ensure that expenditures are adequately identified, accounted for and allocable to agreements.

##### **Response**

These expenditures were allowable and reasonable ones for Enchanted Skies Park and clearly can be funded with federal funds for the project.

UNM recognizes that it initially could have charged these expenditures to the federal funds. However, PIA DO8809 provides UNM full discretion to decide which expenditures should be charged to federal funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding.

**Finding No. 8 – Insufficient Accounting of Blanket Purchase Orders****Condition**

During our review, it was noted that UNM did not immediately charge all project expenditures to appropriate accounts. UNM held expenditures accrued under open blanket purchase orders for over two years before charging fund accounts. Further review revealed UNM's Financial Reporting System (FRS) does not show any encumbrances issued for consultant blanket purchase orders. A blanket purchase order was issued to a consultant for a period of time longer than the Proposal of Services.

**Criteria**

- Section 13-1-169, NMSA 1978 of the New Mexico Procurement Code states that "The central purchasing office may consolidate procurements and may contract for items of tangible personal property or services at a firm price at which the items or services needed during the year or portion of a year shall be purchased;" and,
- UNM Business Policy 4320, Section 4.2 Blanket and Open Purchase Orders, states that "Blanket Purchase Orders are encumbered by the University accounting system."

**Effect**

UNM is in noncompliance with state statutes and its own business policy.

**Cause**

The Lodestar project accountant mistakenly referred to some of the purchase orders for the Lodestar consultants as blanket purchase orders, rather than open purchase orders.

**Recommendation**

In future agreements with NMSHTD, UNM comply with the Procurement Code and applicable regulations regarding blanket purchase orders.

**Response**

There was no violation of the referenced provisions of the Procurement Code because UNM is not subject to those provisions, nor is UNM out of compliance with its internal policies regarding purchase orders.

UNM is not required to follow encumbrance accounting and does so only for internal management reporting. The auditor identified the subject purchase order as a "blanket" order instead of an "open" order. Blanket orders are for the purchase of tangible goods. This procurement was for a service. "Blankets" are internally encumbered. "Open" orders are not. Under provisions of PIA D08809, UNM has full discretion in determining the source of funds to charge for Enchanted Skies Park expenditures, i.e. state or federal.

**Finding No. 9 – Insufficient Source Documentation****Condition**

Upon review of expenditures under PIA D08809, insufficient source documentation was not supported

or substantiated for the Enchanted Skies Park project. For example:

- Source documents did not contain justifications substantiating purchases made with NMSHTD funds; and,
- Source documents identified only "Lodestar" or "Lodestar Project" as the source in which the expenditures were incurred.

#### Criteria

- PIA D08809, Section VII – Financial Accountability, "UNM will maintain the State Funds in a separate UNM restricted account, and provide separate detailed accounting to the state, upon request, of all expenditures and transfers made from the State Funds;" and,
- PIA D08809, Section VIII – Audit, " UNM represents that its system of internal accounting controls is prudent and accurate and that it maintains supporting documentation for all accounting transactions. Its records are consistent with generally accepted accounting principles, and in accordance with federal agency requirements."

#### Effects

- Noncompliance with PIA D08809;
- Lack of consistent accounting and internal control methodology;
- Possible overpayment of expenditures; and,
- Inadequate audit trail.

#### Cause

UNM did not establish a source document system that provided the required detail needed to separate Enchanted Skies Park expenditures from Lodestar project costs.

#### Recommendation

For future agreements with NMSHTD, UNM ensure that source documents are required on all expenditures and that full explanations are required on all purchase orders, invoices and expenditures.

#### Response

UNM made all requested source documentation available to the auditor. UNM is not aware of any deficiency in expenditure documentation or in its system of internal accounting controls.

#### **Finding No. 10 – Misclassified Marketing Expenditures**

##### Condition

During our review of source documents, it was noted UNM expended NMSHTD funds on Lodestar project marketing services and related expenditures, which were unallowable under PIA D08809.

##### Criteria

In accordance with PIA D08809, Section VI – Use of Funds, "UNM may use the State Funds for

**Cause**

UNM misclassified general expenditures by charging NMSHTD funds rather than the federal grant.

**Recommendation**

For future agreements with NMSHTD, UNM ensure that source documents are required on all expenditures and that full explanations are required on all purchase orders, invoices and expenditures.

**Response**

These were all allowable and reasonable expenses for Enchanted Skies Park.

UNM recognizes that it could have initially charged these expenditures to the federal funds. However, PIA D08809 provides UNM full discretion to decide which expenditures should be charged to federal funds and which should be charged to state funds. UNM was concerned with its obligation to charge equal amounts to federal and state. While UNM believes there has been no significant misclassification of expenditures, any costs with which the auditor is uncomfortable can be exchanged with other costs initially recorded against federal funds. These other costs have been identified as appropriate to either state or federal funding.

**Part III – SYSTEM IMPROVEMENT SUGGESTIONS****Suggestion No. 1 – Interest Earned on Funds****Condition**

On June 30, 2001 UNM terminated its federal Lodestar grant of which the Enchanted Skies Park was a component; however, NMSHTD has not received payment from UNM for the interest earned on the \$12 million state road funds received under PIA D08809. UNM's report to the Legislative Finance Committee stated that as of May 31, 2001 it had accrued \$1,246,164 in interest since it received the funds.

**Suggestion**

UNM and NMSHTD negotiate on an equitable settlement on the interest earned.

**Response**

The University of New Mexico and the State Highway and Transportation Department will negotiate the status of payment on interest earned.

**Suggestion No. 2 – Improve Records Management****Condition**

Upon our review of the UNM Purchasing Department's documents and requests for pertinent data, it



was noted that UNM's records management was insufficient. For example:

- Consultant proposals, blanket purchase orders, modifications and request for proposals with responses were not properly filed or organized; and,
- Pertinent accounting data and documents were either lost or misplaced.

#### Suggestion

For future agreements with NMSHTD, UNM's Contract and Grant Administration ensure all future project records are properly documented and retained and that UNM's Purchasing Department file all consultant documentation accordingly and in an organized manner.

#### Response

UNM is always interested in improving its systems for maintaining documentation and other internal control mechanisms and will give this suggestion careful consideration.

MP:SE

xc: Pete Rahn., Secretary, NMSHTD  
Julie Weeks, Vice President for Business & Finance, UNM  
Audit File